



TEST REPORT IEC 60669-1 Switches for household and similar fixed-electrical installations Part 1: General requirements	
Report Reference No.	70.410.12.1009.02-01
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Testing Laboratory	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
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Applicant's name	Lumi Legend Electrical Co., Ltd.
Address	No.18, Lane 239, Beihai Road, Jiangbei, Ningbo 315032, China
Test specification:	
Standard	IEC 60669-1:1998 (Third Edition) + A1:1999 + A2:2006
Test procedure	TÜV product service regulation
Non-standard test method.....	N/A
Test Report Form No.	IEC60669_1D
Test Report Form(s) Originator	IMQ S.p.A.
Master TRF	Dated 2009-03
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Test item description	Switches for household and similar fixed el. Installations, Wall USB charger
Trade Mark	lumitek (for end product)
Manufacturer	Same as applicant
Model/Type reference.....	LM60044, LB60044 (for end product)
Ratings	Input: 100-250V~ 50/60Hz; Output: 5Vd.c., 2.1A (two ways max.)

Testing procedure and testing location:

☒ **Testing Laboratory:** TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Testing location/ address.....: No. 1999, Duhui Road, Shanghai, 201108, P. R. China

☐ **Associated Test Laboratory:** N/A

Testing location/ address.....: N/A

Tested by (name + signature): Jie ZHU

Approved by (+ signature): Yi ZHU



☐ **Testing procedure: TMP**

Tested by (name + signature):

Approved by (+ signature):

Testing location/ address.....:

☐ **Testing procedure: WMT**

Tested by (name + signature):

Witnessed by (+ signature).....:

Approved by (+ signature):

Testing location/ address.....:

☐ **Testing procedure: SMT**

Tested by (name + signature):

Approved by (+ signature):

Supervised by (+ signature).....:

Testing location/ address.....:

☐ **Testing procedure: RMT**

Tested by (name + signature):

Approved by (+ signature):

Supervised by (+ signature).....:

Testing location/ address.....:

Summary of testing:	
Tests performed (name of test and test clause): 1. All of the tests were performed on LM60044. 2. Determination of the test result includes consideration of measurement uncertainty from the test equipment and methods. 3. We conclude that the products described in this test report comply with the standard according to the testing results on the submitted samples.	Testing location: TüV SüD Certification and Testing (China) Co., Ltd. Shanghai Branch No. 1999, Duhui Road, Shanghai, 201108, P. R. China
Summary of compliance with National Differences: The whole product(s) has been evaluated and also comply with the standard EN 60669-1: 1999 + A1: 2002 + A2: 2008. See attachment to IEC 60669-1 for European group differences and national differences.	
Copy of marking plate: See CDF	

Test item particulars	
Pattern number	N/A
Contact opening (gap)	normal gap / mini-gap / micro-gap / without contact gap (semiconductor switching device)
Degree of protection against access to hazardous parts and against harmful effects due to the ingress of solid foreign objects	IP2X / IP4X / IP5X
Degree of protection against harmful effects due to the ingress of water	IPX0 / IPX4 / IPX5
Method of actuating	rotary / tumbler / rocker / push-button / cord-operated / momentary contact
Method of application	surface-type / flush-type / semi-flush-type / panel-type / architrave-type
Method of installation	design A / design B
Type of terminals	screw-type / screwless (rigid) / screwless (rigid and flexible)
Flexible cable outlet	without / with
Rated voltage (V).....	110-250V~
Rated current (A)	Output: 5Vd.c., 2.1A (two ways max.) for USB charger
Possible test case verdicts:	
- test case does not apply to the test object.....	N/A
- test object does meet the requirement	Pass (P)
- test object does not meet the requirement	Fail (F)
Testing	
Date of receipt of test item	2012-10-09; 2016-04-19
Date (s) of performance of tests	2012-10-09 to 2012-11-19; 2016-04-20 to 2016-06-17
General remarks:	
<p>The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.</p> <p>"(see Enclosure #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report.</p> <p>Throughout this report a comma (point) is used as the decimal separator.</p>	

This test report replaces the previous version 70.410.12.1009.02-00 issued on 2012-11-26 due to the modifications mentioned as below:

- Standard updated

The following contents are included and as attachments of this test report:

- Test report EN 60669-1:1999/A2:2008
- Test report EN 61558-1:2005/A1:2009+ EN 61558-2-16:2009/A1:2013
- Photo documentation
- Data form for electrical equipment and machinery

General product information:

1. The product is intended for fixed installation.

2. We conclude that the product(s) presented in this test report complies ~~(comply)~~ with the standard according to the test results on the submitted samples.

IEC 60669-1			
Clause	Requirement + Test	Result - Remark	Verdict
8	MARKING		
8.1	Switches marked with:		
	- rated current (A) or rated fluorescent load (AX) or a combination of both if the two ratings are different:	-	N/A
	- rated voltage (V)	110-250	P
	- symbol for nature of supply	~	P
	- manufacturer's or responsible vendor's name, trade mark or identification mark	See page 1	P
	- type reference	See page 1	P
	- symbol for mini-gap construction (m)	-	N/A
	- symbol for micro-gap construction (μ)	-	N/A
	- symbol for semiconductor switching device (under consideration)	-	N/A
	- first IP characteristic numeral, if declared higher than 2, in which case the second characteristic numeral is also marked	IP 2X	N/A
	- second IP characteristic numeral, if declared higher than 0, in which case the first characteristic numeral is also marked	IP X0	N/A
	Switches with screwless terminals: marked with an indication of the suitability to accept rigid conductors only (if any)	-	N/A
	Flexible cable outlet switches: information of minimum and maximum sizes for which the anchorage is provided put on the switch and/or the packaging unit	-	N/A
8.2	Symbols used: as required in the standard	OK	P
	Marking for the nature of supply placed next to the marking for rated current and rated voltage	OK	P
8.3	Marking of switches placed on the main part:		
	- rated current, rated voltage and nature of supply	OK	P
	- either the name, trade mark, or identification mark of the manufacturer or of the responsible vendor	OK	P
	- length of insulation to be removed, if any	-	N/A
	- symbol for mini-gap construction, micro-gap construction or semiconductor switching device, if any	-	N/A
	- type reference	OK	P
	Cover plates necessary for safety purposes and intended to be sold separately: marked with the manufacturer's or responsible vendor's name, trade mark or identification mark and type reference	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	IP code, when applicable, marked so as to be easily discernible when the switch is mounted and wired as in normal use		N/A
	Marking clearly visible and easily legible	OK	P
	Markings shall be placed on parts which cannot be removed without the use of a tool	OK	P
8.4	Terminals for phase conductors (supply conductors): identified unless method of connection is of no importance, self evident or indicated on a wiring diagram	OK, self evident	P
	Indications not placed on screws or other easily removable part	OK	P
	Terminals associated with any one pole for switches of pattern number 2, 3, 03 and 6/2: similar identification differing from that of terminals associated with other poles	OK	P
8.5	Neutral terminals: N	-	N/A
	Earthing terminals: [earth symbol]	-	N/A
	Markings not placed on screws or other easily removable parts	-	N/A
	Terminals for conductors not forming part of the main function of the switch:		
	- clearly identified unless their purpose is self evident, or	-	N/A
	- indicated in a wiring diagram fixed to the accessory	-	N/A
	Identification of equipment terminals may be achieved by:		
	- their marking with graphical symbols according to IEC 60417 or colours and/or alphanumeric system, or	-	N/A
	- their physical dimension or relative location	-	N/A
8.6	Switches marked to indicate the switch position: they are so marked that the direction of movement of the actuating member to its different positions or the actual position is clearly indicated.....	-	N/A
	Switches having more than one actuating member: marking indicates the effect achieved by the operation	-	N/A
	Marking clearly visible on the front of the switch	-	N/A
	Not possible to fix cover, cover plate, or removable actuating members in an incorrect position	-	N/A
	Symbols for "on" and "off" not used for indication of switch positions unless clearly indicate the direction of movement of the actuating members	-	N/A
8.7	Red colour only for push-button to open the circuit	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
8.8	Special precautions necessary to take when installing the switch: details of these and clear information given in an instruction sheet which accompanies the switch	-	N/A
8.9	Marking durable and easily legible. Test: 15 s with water and 15 s with petroleum spirit	OK	P

9	CHECKING OF DIMENSIONS		
	Switches and boxes comply with the appropriate standard sheets	-	N/A
	Type of boxes in which switches are to be mounted: specified in manufacturer's catalogue	-	N/A

10	PROTECTION AGAINST ELECTRIC SHOCK		
10.1	Switches: live parts not accessible	OK	P
	Test with standard test finger shown in figure 1 of IEC 60529	OK	P
	Switches with thermoplastic or elastomeric material: additional test carried out at $35\text{ °C} \pm 2\text{ °C}$ with a straight unjointed test finger (75 N for 1 min)	OK	P
	Straight unjointed test finger applied to thin-walled knock-outs with a force of 10 N	-	N/A
	During the test: switches not deform and no live parts accessible	OK	P
10.2	Knobs, operating levers, push buttons, rockers and the like: of insulating material, unless:	OK	P
	- accessible metal parts separated from metal parts of mechanism by double or reinforced insulation, or	-	N/A
	- reliably connected to earth	-	N/A
10.3	Accessible parts of switches with $I_n \leq 16\text{ A}$: made of insulating material	OK	P
10.3.1	Metal covers or cover plates protected by supplementary insulation made by insulating linings or insulating barriers	-	N/A
	Insulating linings or insulating barriers:		
	- cannot be removed without being permanently damaged, or designed that	-	N/A
	- cannot be replaced in an incorrect position; if they are omitted, accessories are rendered inoperable or manifestly incomplete; there is no risk of accidental contact between live parts and metal covers or cover plates; precautions are taken to prevent creepage distances or clearances becoming less than the values specified in clause 23	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
10.3.2	Earthing of metal covers or cover plates: connection of low resistance	-	N/A
10.4	Metal parts of mechanism not insulated from live parts: not protrude from enclosure	-	N/A
	Switches operated by means of a removable key or similar device: metal parts of mechanism insulated from live parts	-	N/A
10.5	Metal parts of mechanism not accessible and insulated from accessible metal parts, unless	-	N/A
	- separated from live parts (creepage distances and clearances have at least twice the value specified in clause 23), or	-	N/A
	- reliably connected to earth	-	N/A
10.6	Switches operated by means of a removable key or an intermediate part: key or an intermediate part can only touch parts insulated from live parts	-	N/A
	key or intermediate part: insulated from metal parts of mechanism, unless	-	N/A
	creepage distances and clearances between live parts and metal parts of mechanism have at least twice the values specified in clause 23	-	N/A
10.7	Cord-operated switches: impossible to touch live parts when fitting or replacing the pull cord	-	N/A

11	PROVISION FOR EARTHING		
11.1	Accessible metal parts: provided with, or permanently and reliably connected to, an earthing terminal	-	N/A
11.2	Earthing terminals: with screw clamping or screwless terminals and comply with clause 12	-	N/A
	Capacity of earthing terminals not less than that of the corresponding terminals for the supply conductors	-	N/A
	Any additional external earthing terminal has a size suitable for conductors of at least $6 \text{ mm}^2 (\text{mm}^2)$	-	N/A
11.3	Surface-type switches with an enclosure of insulating material, with IP > X0 and more than one cable inlet, are provided for the continuity of the earthing circuit with:		
	- an internal fixed earthing terminal, or	-	N/A
	- adequate space for a floating terminal allowing the connection of an incoming and outgoing conductor	-	N/A
11.4	Connection between earthing terminal and accessible metal parts: of low resistance	-	N/A
	Test current equal to $1,5 I_n$ or 25 A (A)	-	—
	Resistance $\leq 0,05 \Omega (\Omega)$	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict

12	TERMINALS		
12.1	General		
	Switches provided with screw-type terminals or with screwless terminals	Screw-type terminals	P
	Clamping means of terminals: not serve to fix any other components	OK	P
	All the test on terminals, with the exception of the test of 12.3 11, made after the test of 15.1	OK	P
12.2	Terminals with screw clamping for external copper conductors		
12.2.1	Switches provided with terminals which allows the proper connection of copper conductors as shows in table 2	OK	P
	Rated current (A)	-	—
	Type of conductor (rigid / flexible)	Rigid conductor	—
	Smallest / largest cross-sectional area (mm ²)	1,0 / 2,5	—
	Diameter of largest conductor (mm)	2,13	—
	Figure of terminal	4 / 2 / 3 / 4 / 5	—
	Minimum diameter D (minimum dimensions) of conductor space: required (mm); measured (mm) ...	2,0; 2,8	P
12.2.2	Terminals allow the conductor to be connected without special preparation	OK	P
12.2.3	Terminals have adequate mechanical strength	OK	P
	Screws and nut for clamping the conductors have metric ISO thread or a comparable thread	OK	P
	Screws not of soft metal such as zinc or aluminium	OK	P
12.2.4	Terminals resistant to corrosion	OK	P
12.2.5	Screw-type terminals clamp the conductor(s) without undue damage	See appended table 12.2.5	P
	During the test: conductor not slip out, no break near clamping unit and no damage	OK	P
12.2.6	Terminals clamp the conductor reliably between metal surfaces	See appended table 12.2.6	P
	During the test: conductor not move noticeably	OK	P
12.2.7	Terminals designed or placed that the conductor cannot slip out while the clamping screws or nuts are tightened	See appended table 12.2.7	P
	After the test: no wire of the conductor escaped outside the clamping unit thus reducing creepage distances and clearances to values lower than those indicated in clause 23	OK	P

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Clause	Requirement + Test	Result - Remark	Verdict
12.2.8	Terminals not work loose from their fixing to the switch	OK	P
	Torque test:		
	- rated current (A)	-	—
	- solid rigid copper conductor of the largest cross-sectional area (mm ²) (table 2)	2,5	—
	- torque (Nm) (table 3 or appropriate figures 1, 2, 3, 4)	0,8	—
	Screws and nuts tightened and loosened 5 times. During the test: terminals not work loose and show no damage	OK	P
12.2.9	Clamping screws or nuts of earthing terminals: adequately locked against accidental loosening, not possible to loosen them without the aid of a tool	-	N/A
12.2.10	Earthing terminals: no risk of corrosion	-	N/A
	Body of brass or other metal no less resistant to corrosion	-	N/A
	If the body is a part of a frame or enclosure of aluminium alloy, precautions are taken to avoid the risk of corrosion	-	N/A
12.2.11	Pillar terminals: distance g no less than the value specified in figure 1: required (mm); measured (mm) :	-	N/A
	Mantle terminals: distance g no less than the value specified in figure 5: required (mm); measured (mm) :	-	N/A
12.2.12	Lug terminals:		
	- used only for switches having rated current ≥ 40 A	-	N/A
	- fitted with spring washers or equally effective locking means	-	N/A
12.3	Screwless terminals for external copper conductors		
12.3.1	Screwless terminals of the type suitable for:		
	- for rigid copper conductors only, or	-	N/A
	- for both rigid and flexible copper conductors (tests carried out with rigid and then repeated with flexible conductors)	-	N/A
12.3.2	Screwless terminals provided with clamping units which allow the proper connection of rigid or of rigid and flexible conductors having nominal cross-sectional areas as shown in table 7	-	N/A
	Rated current (A)	-	—
	Type of conductor (rigid / flexible)	-	—
	Smallest / largest cross-sectional area (mm ²)	-	—
	Diameter of largest rigid conductor (mm)	-	—

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Clause	Requirement + Test	Result - Remark	Verdict
	Diameter of largest flexible conductor (mm)		—
12.3.3	Screwless terminals allow the conductor to be connected without special preparation	-	N/A
12.3.4	Parts of screwless terminals intended for carrying current of materials as specified in 22.5	-	N/A
12.3.5	Screwless terminals clamp specified conductors with sufficient contact pressure without undue damage to the conductor	-	N/A
	Conductor clamped between metal surfaces	-	N/A
12.3.6	It is clear how the connection and disconnection of the conductors is to be made	-	N/A
	Disconnection of a conductor require an operation, other than a pull, so that can be made manually with or without a general-purpose tool	-	N/A
	It is not possible to confuse the opening for the use of a tool with the opening intended for the conductor	-	N/A
12.3.7	Screwless terminals intended for the interconnection of two or more conductors:		
	- during insertion, operation of clamping means of one of the conductors is independent of operation of that for the other conductor(s);	-	N/A
	- during disconnection, conductors can be disconnected either at the same time or separately;	-	N/A
	- each conductor introduced in a separate clamping unit.	-	N/A
	It is possible clamp securely any number of conductors up to the maximum as designed. Number of conductors; Nominal cross-sectional area (mm ²)	-	N/A
12.3.8	Screwless terminals: adequate insertion obvious and over-insertion prevented	-	N/A
	Screwless terminals of switches: undue insertion of the conductor prevented by a stop if further insertion is liable to reduce creepage distances and/or clearances required in table 20 or to influence the mechanism	-	N/A
12.3.9	Screwless terminals properly fixed to the switch	-	N/A
	Not work loose when conductors are connected or disconnected	-	N/A
	Self-hardening resins used to fix terminals not subject to mechanical stress	-	N/A
12.3.10	Screwless terminals withstand mechanical stresses occurring in normal use	See appended table 12.3.10	N/A
	During application of the pull conductor not come out of the terminal	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Test with apparatus shown in figure 10	See appended table 12.3.10	N/A
	During the test conductors not move noticeably in the clamping unit	-	N/A
	After these tests: neither terminals nor clamping means have worked loose and conductors show no deterioration	-	N/A
12.3.11	Screwless terminals withstand electrical and thermal stresses occurring in normal use	See appended table 12.3.11	N/A
	After the test: inspection show no changes	-	N/A
	Repetition of test according to 12.3.10: screwless terminals withstand mechanical stresses occurring in normal use	See appended table 12.3.11	N/A
	During application of the pull conductor not come out of the terminal	-	N/A
	Test with apparatus shown in figure 10	See appended table 12.3.11	N/A
	During the test conductors not move noticeably in the clamping unit	-	N/A
	After these tests: neither terminals nor clamping means have worked loose and conductors show no deterioration	-	N/A
12.3.12	Screwless terminals: connected rigid solid conductor remains clamped, even when deflected during normal installation	See appended table 12.3.12	N/A

13	CONSTRUCTIONAL REQUIREMENTS		
13.1	Insulating lining, barriers and like: adequate mechanical strength and secured in a reliable manner	OK	P
13.2	Switches constructed so as to permit:		
	- easy introduction and connection of the conductors in the terminals;	OK	P
	- correct positioning of the conductors	OK	P
	- easy fixing of the switch to a wall or in a box	OK	P
	- adequate space between underside of the base and the surface on which the base is mounted or between the sides of the base and the enclosure (cover or box)	-	N/A
	Surface-type switches: fixing means do not damage insulation of the cable	-	N/A
	Switches classified as design A: permit easy positioning and removal of the cover or cover plate, without displacing the conductors	OK	P
13.3	Covers, cover-plates and actuating members or parts of them intended to ensure protection against electric shock:		

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Clause	Requirement + Test	Result - Remark	Verdict
	- held in place at two or more points by effective fixings	OK, cover plate and rocker	P
	- fixed by means of a single fixing, e.g. by a screw, provided that they are located by another means (e.g. by a shoulder)	-	N/A
	Fixings of covers, cover-plates or actuating members of switches of design A serves to fix the base: there is means to maintain the base in position, even after removal of the covers, cover-plates or actuating members	OK	P
13.3.1	Covers, cover plates or actuating members whose fixing is of the screw-type:		
	Compliance checked by inspection only	-	N/A
13.3.2	Covers, cover plates or actuating members whose fixing is not dependent on screws and whose removal is obtained by applying a force in a direction approximately perpendicular to the mounting/supporting surface:		
	Compliance checked, when their removal may give access, with the standard test finger:		
	to live parts: by the test of 20.4 (verification of the non-removal and the removal)	-	N/A
	to non-earthed metal parts separated from live parts by creepage distances and clearances according to table 20: by the test of 20.5 (verification of the non-removal and the removal)	-	N/A
	only to insulating parts, or earthed metal parts, or metal parts separated from live parts by creepage distances and clearances twice those according to table 20, or live parts of SELV circuits not greater than 25 V a.c.: by the test of 20.6 (verification of the non-removal and the removal)	-	N/A
13.3.3	Covers, cover-plates or actuating members whose fixing is not dependent on screws and whose removal is obtained by using a tool, in accordance with the manufacturer's information given in an instruction sheet or in a catalogue:		
	Compliance checked, when their removal may give access, with the standard test finger:		
	to live parts: by the test of 20.4 (verification of the non-removal only)	OK, cover for USB port	P
	to non-earthed metal parts separated from live parts by creepage distances and clearances according to table 20: by the test of 20.5 (verification of the non-removal only)	-	N/A
	only to insulating parts, or earthed metal parts, or metal parts separated from live parts by creepage distances and clearances twice those according to table 20, or live parts of SELV circuits not greater than 25 V a.c.: by the test of 20.6 (verification of the non-removal only)	OK, frame	P

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Clause	Requirement + Test	Result - Remark	Verdict
13.4	Switches: no free openings in their enclosures according to their IP classification	OK	P
13.5	Knobs of rotary switches securely attached to the shaft or part operating the mechanism	-	N/A
	- axial pull test: 100 N for 1 min	-	N/A
	- knob of switches having only one direction of operation: turned 100 times in the reverse direction	-	N/A
	During the test: knob not become detached	-	N/A
13.6	Screws or other means for mounting the switch on a surface or in a box or enclosure: easily accessible from the front.	OK	P
	Fixing means not serve any other fixing purpose	OK	P
13.7	Combinations of switches, or of switches and socket-outlets, comprising separate bases: correct position of each base ensured	-	N/A
	Fixing of each base independent of the fixing of the combination to the mounting surface	-	N/A
13.8	Accessories combined with switches: comply with their standard	-	N/A
13.9	Surface-type switches with IP > 20 are in according to their classification when fitted with conduits or with sheathed cables	OK	P
	Surface-type switches with IPX4 or IPX5 have provisions for opening a drain hole	-	N/A
	Switches provided with a drain hole: it is not less than 5 mm in diameter, or 20 mm ² in area with a width and a length not less than 3 mm	Ø — mm / mm ²	N/A
	Drain hole: effective	-	N/A
	Lid springs (if any): of corrosion resistant material (bronze or stainless steel)	-	N/A
13.10	Switches to be installed in a box: conductor ends can be prepared after the box is mounted in position, but before the switch is fitted in the box	-	N/A
	Base have adequate stability when mounted in the box	-	N/A
13.11	Surface-type switches with IP > X0, pattern numbers 1, 5 and 6, with more than one inlet opening, provided with:		
	- fixed additional terminal complying with the requirements of clause 12, or	-	N/A
	- adequate space for a floating terminal	-	N/A
13.12	Inlet openings: allow the introduction of the conduit or the sheath of the cable	-	N/A
	Surface-type switches: intended conduit or protective covering can enter at least 1 mm into the enclosure	OK	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Inlet openings for conduit entries of surface-type switches: capable of accepting conduit sizes of 16, 20, 25 or 32 or a combination of at least two of these sizes not excluding two of the same size	-	N/A
	Inlet openings for cable entries of surface-type switches: capable of accepting cables having the dimensions specified in table 12 or be as specified by the manufacturer: rated current (A); limits of external diameter of cables min/max (mm)	-	N/A
13.13	Surface-type switches: provision for back entry (if are intended)	-	N/A
13.14	Membranes or the like (if provided): replaceable	-	N/A
13.15	Requirements for membranes in inlet openings		
13.15.1	Membranes reliably fixed and not displaced by the mechanical and thermal stresses occurring in normal use	-	N/A
	Test on membranes subjected to the ageing treatment specified in 15.1 and fitted with the switches		
	Switches placed at 40 °C for 2 h. Force of 30 N applied for 5 s by test finger. During the test: no deformation, live parts not accessible	-	N/A
	Membranes likely to be subjected to an axial pull: axial pull of 30 N applied for 5 s. During the test: membranes not come out	-	N/A
	After the test: no harmful deformation, cracks or similar damage	-	N/A
	Test repeated with membranes not subjected to any treatment	-	N/A
13.15.2	Membranes in inlet openings: introduction of the cables into the accessory permitted when the ambient temperature is low	-	N/A
	Test on membranes not subjected to the ageing treatment specified in 15.1 and fitted with the switches		
	Switches kept at -5 °C for 2 h: possibility to introduce cables of the heaviest type through the membranes	-	N/A
	After the test: no harmful deformation, cracks or similar damage	-	N/A
13.16	Flexible cable outlet switches: flexible cable (60245 IEC 66 or 60227 IEC 53, or as specified by the manufacturer) may enter the switch through a suitable hole, groove or gland	-	N/A
	Maximum dimension of flexible cable having conductors specified in table 12a accepted by the entry:		
	- rated current (A)	-	—

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Clause	Requirement + Test	Result - Remark	Verdict
	- cross-sectional area (mm ²) (min 1,5 mm ²)	-	—
	Entry shaped to prevent damage to the flexible cable	-	N/A
	Flexible cable outlet switches: provided with cable anchorage	-	N/A
	Cable anchorage: contains the sheath, of insulating material or provided with an insulating lining fixed to the metal parts	-	N/A
	Cable anchorage: anchor the flexible cable securely to the switch	-	N/A
	Cable anchorage cannot be released from the outside	-	N/A
	Use of a special purpose tool not required	-	N/A
	Screws: not serve to fix any other component, unless	-	N/A
	- switch is rendered manifestly incomplete if component omitted or replaced in an incorrect position, or	-	N/A
	- component cannot be removed without further use of a tool	-	N/A
	Pull test (30 N, 25 times): cable 60227 IEC 53, cross-sectional area 1,5 mm ² ; torque (Nm) (2/3 table 3)	-	N/A
	Torque test: torque 0,15 Nm for 1 min, cable not displaced > 2 mm	-	N/A
	Pull test (60 N, 25 times): cable 60245 IEC 66, diameter (mm) of cable; torque (Nm) (2/3 table 3) ...	-	N/A
	Torque test: torque 0,35 Nm for 1 min, cable not displaced > 2 mm	-	N/A
	Test voltage of 2000 V a.c. applied for 1 min between the conductors and any metal clamp of the cord anchorage:		
	During the test: insulation of flexible cable not damaged (no breakdown or flashover)	-	N/A

14	MECHANISM		
14.1	Actuating member of a switch, when released, automatically take up the position corresponding to that of moving contacts	-	N/A
14.2	Moving contact of switches can come to rest only in "on" and "off" positions	-	N/A
	Intermediate position permissible if:		
	- it corresponds to the intermediate position of the actuating member, and	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- the insulation between fixed and moving contacts is adequate. Electric strength test as specified in 16.2: test voltage a.c. for 1 min (V)	500 V / 750 V / 1250 V / 2000 V	N/A
14.3	No undue arcing in slowly operation	-	N/A
	Test carried out at the end of the test of clause 19.1: breaking of the circuit 10 times, actuating member moved over a period of 2 s. During the test: no sustained arcing	-	N/A
14.4	Switches of pattern numbers 2, 3, 03 and 6/2 make and break all poles substantially simultaneously	-	N/A
	Neutral pole of switches of pattern numbers 03 not make after or break before the other poles	-	N/A
14.5	Action of the mechanism: independent of the presence of cover or cover plate. Test: no flicker	-	N/A
14.6	Cord-operated switches: effecting a change by application and removal a pull not exceeding:		
	- 45 N applied vertically, and	-	N/A
	- 65 N applied at 45° ± 5°	-	N/A

15	RESISTANCE TO AGEING, PROTECTION PROVIDED BY ENCLOSURES OF SWITCHES, AND RESISTANCE TO HUMIDITY		
15.1	Resistance to ageing		
	Switches and boxes placed for 7 days (168 h) in a heating cabinet at 70 °C ± 2 °C	OK	P
	- no crack visible after test with normal or corrected vision without additional magnification	OK	P
	- no sticky or greasy material as a result of heat	OK	P
	- no trace of cloth (forefinger pressed with 5 N)	OK	P
	- no other damage as a result of heat	OK	P
15.2	Protection provided by enclosures of switches		
15.2.1	Protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects		
	Enclosure of the switch provides a degree of protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects in accordance with the IP classification of the switch	OK, IP 20	P
	Glands: torque (Nm) (2/3 of torque applied in 20.3) :	-	—
	Screws of the enclosure: torque (Nm) (2/3 table 3)	-	—
15.2.1.1	Protection against access to hazardous parts		
	Appropriate test according to IEC 60529	IP 2X	P
15.2.1.2	Protection against harmful effects due to ingress of solid foreign objects		

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Clause	Requirement + Test	Result - Remark	Verdict
	Appropriate test according to IEC 60529	IP 2X	N/A
	Dust not penetrate in quantity to interfere with satisfactory operation or to impair safety	-	N/A
15.2.2	Protection against harmful effects due to ingress of water		
	Enclosure of switches provide a degree of protection against harmful effects due to ingress of water in accordance with their IP classification	-	N/A
	Appropriate test according to IEC 60529	IP X0	N/A
	Flush-type and semi-flush-type switches fixed:		
	- in a test wall using an appropriate box in accordance with the manufacturer's instructions	-	N/A
	- in a test wall according to figure 27	-	N/A
	Screws of the enclosure: torque (Nm) (2/3 table 3)	-	—
	Glands: torque (Nm) (2/3 of torque applied in table 19)	-	—
	Specimens withstand an electric strength test specified in 16.2 which is started within 5 min of completion of the test	-	N/A
15.3	Resistance to humidity		
	Switches proof against humidity which may occur in normal use	OK	P
	Compliance checked by a humidity treatment carried out in a humidity cabinet containing air with relative humidity maintained between 91 % and 95 %. Specimens kept in the cabinet for:		
	- 2 days (48 h) for switches with IPX0	OK	P
	- 7 days (168 h) for switches with IP>X0	-	N/A
	After this treatment: specimens show no damage	OK	P

16	INSULATION RESISTANCE AND ELECTRIC STRENGTH		
16.1	The insulation resistance measured 1 min after application of 500 V d.c.	See appended table 16.1	P
16.2	Electric strength: a.c. test voltage applied for 1 min	See appended table 16.2	P

17	TEMPERATURE RISE		
17.1	Switches so constructed that the temperature rise in normal use is not excessive	See appended table 17	P
	No oxidation or any other deterioration of contacts	OK	P
17.2	Switches incorporating or intended to incorporate pilot lights are designed that in normal use temperature of the accessible surface is not excessive	OK	P

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Clause	Requirement + Test	Result - Remark	Verdict

18	MAKING AND BREAKING CAPACITY		
	Switches have adequate making and breaking capacity	-	N/A
	- model/type reference	-	—
	- pattern number	-	—
	- rated voltage (V)	-	—
	- rated current (A)	-	—
	- nominal cross-sectional area as for the test of clause 17 (mm ²)	-	—
18.1	Test with cos ϕ 0,3 alternating current		
	- test voltage (1,1 V _n) (V)	-	—
	- test current (1,25 I _n) (cos ϕ 0,3) (A)	-	—
	- 200 operations; rate (operations per minute)	-	—
	- samples number	-	—
	During the test: no sustained arcing	-	N/A
	After the test: specimens show no damage	-	N/A
18.2	Test with tungsten filament lamps load (switches with I _n ≤ 16 A / V _n ≤ 250 V and switches of pattern numbers 3 and 03 with V _n > 250 V)		
	- test voltage (V _n) (V)	-	—
	- test current (≥ 1,2 I _n) (A)	-	—
	- number of 200 W tungsten filament lamps	-	—
	- 200 operations; rate (operations per minute)	-	—
	- samples number	-	—
	During the test: no sustained arcing nor welding of the contacts	-	N/A
	After the test: specimens show no damage	-	N/A

19	NORMAL OPERATION		
19.1	Switches withstand without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses occurring in normal use	-	N/A
	- model/type reference	-	—
	- pattern number	-	—
	- nominal cross-sectional area per clause 18 (mm ²)	-	—
	- test voltage (V _n) (V)	-	—

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Clause	Requirement + Test	Result - Remark	Verdict
	- test current (In) (cos ϕ 0,6) (A)	-	—
	- number of operations per table 17	-	—
	- rate (operations per minute)	-	—
	- samples number	-	—
	Reduced electric strength per clause 16	See appended table 19.1	N/A
	Temperature rise test per clause 17 after normal operation	See appended table 19.1	N/A
	After the tests the specimens not show:		
	- wear impairing their further use;	-	N/A
	- discrepancy between the position of the actuating member (if indicated) and that of the moving contacts	-	N/A
	- deterioration of enclosures, insulating lining or barriers;	-	N/A
	- seepage of sealing compound	-	N/A
	- loosening of electrical or mechanical connections;	-	N/A
	- displacement of moving contacts of switches pattern number 2, 3, 03 or 6/2	-	N/A
	No sustained arcing in slowly operation (sub-clause 14.3)	-	N/A
19.2	Switches intended for fluorescent lamp load withstand without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses occurring when controlling fluorescent lamp circuits with power factor correction	-	N/A
	- model/type reference	-	—
	- pattern number	-	—
	- nominal cross-sectional area per clause 18 (mm ²)	-	—
	- rate (operations per minute)	-	—
	- test voltage (Vn); test current (In) (cos ϕ 0,9); number of operations with load A	-	—
	- test voltage (Vn); 100 operations with load B	-	—
	- samples number	-	—
	During the test: copper wire F not melt, specimens function correctly, no sustained arcing or welding of contacts	-	N/A
	Temperature rise test per clause 17 after normal operation	See appended table 19.2	N/A
	After the tests it is possible to make and break the switch by hand, and specimen not show:	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- wear impairing their further use;	-	N/A
	- discrepancy between the position of the actuating member (if indicated) and that of the moving contacts	-	N/A
	- deterioration of enclosures, insulating lining or barriers;	-	N/A
	- loosening of electrical or mechanical connections;	-	N/A
	- seepage of sealing compound	-	N/A
	- displacement of moving contacts of switches pattern number 2, 3 or 6/2	-	N/A

20	MECHANICAL STRENGTH		
	Switches, boxes and screwed glands have adequate mechanical strength	OK	P
20.1	For all types of switches and for boxes: impact test (9 blows)	See appended table 20.1	P
	After the test: no damage, live parts no become accessible	OK	P
20.2	Bases of surface-type switches first fixed to a cylinder of rigid steel sheet of radius equal to 4,5 times the distance between fixing holes (mm)	-	N/A
	Bases then fixed to a flat steel sheet	-	N/A
	Torque applied to fixing screws (Nm)	0,5 Nm / 1,2 Nm	—
	During and after the test: bases show no damage	-	N/A
20.3	Screwed glands of switches other than ordinary: torque test		
	- diameter of cylindrical metal test rod (mm)	-	—
	- type of material	moulded material	—
	- torque for 1 min (table 19) (Nm)	-	—
	After the test: no damage of glands and enclosure of the specimens	-	N/A
20.4	Force necessary for covers, cover-plates or actuating members to come off or not to come off (accessibility with the test finger to live parts)		
20.4.1	Verification of the non-removal of covers, cover-plates or actuating member		
	Force applied for 1 min in direction perpendicular to the mounting surface	40 N / 80 N	—
	Covers, cover-plates or actuating members not come off	Cover of USB port	P
	Test repeated on new specimens with a sheet of hard material, 1 mm ± 0,1 mm thick, fitted around the supporting frame (fig. 19)	OK	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Covers, cover-plates or actuating members not come off	OK	P
	After the test: no damage	OK	P
20.4.2	Verification of the removal of covers, cover-plates or actuating members		
	Force not exceeding 120 N applied 10 times in direction perpendicular to the mounting / supporting surface: covers, cover-plates or actuating members come off	-	N/A
	Test repeated on new specimens with a sheet of hard material, 1 mm ± 0,1 mm thick, fitted around the supporting frame (fig. 19)	-	N/A
	Covers, cover-plates or actuating members come off	-	N/A
	After the test: no damage	-	N/A
20.5	Force necessary for covers, cover-plates or actuating members to come off or not to come off (accessibility with the test finger to non-earthed metal parts separated from live parts by creepage distances and clearances according to table 20)		
20.4.1	Verification of the non-removal of covers, cover-plates or actuating members		
	Force applied for 1 min in direction perpendicular to the mounting surface	10 N / 20 N	—
	Covers or cover-plates not come off	-	N/A
	Test repeated on new specimens with a sheet of hard material, 1 mm ± 0,1 mm thick, fitted around the supporting frame (fig. 19)	-	N/A
	Covers, cover-plates or actuating members not come off	-	N/A
	After the test: no damage	-	N/A
20.4.2	Verification of the removal of covers, cover-plates or actuating members		
	Force not exceeding 120 N applied 10 times in direction perpendicular to the mounting / supporting surface: covers, cover-plates or actuating members come off	-	N/A
	Test repeated on new specimens with a sheet of hard material, 1 mm ± 0,1 mm thick, fitted around the supporting frame (fig. 19)	-	N/A
	Covers, cover-plates or actuating members come off	-	N/A
	After the test: no damage	-	N/A
20.6	Force necessary for covers, cover-plates or actuating members to come off or not to come off (accessibility to insulating parts, earthed metal parts, live parts of SELV ≤ 25 V a.c. or metal parts separated from live parts by creepage distances twice those according to table 20)		
20.4.1	Verification of the non-removal of covers, cover-plates or actuating members		

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Clause	Requirement + Test	Result - Remark	Verdict
	Force 10 N applied for 1 min in direction perpendicular to the mounting surface: covers, cover-plates or actuating members not come off	OK, Cover of USB port	P
	Test repeated on new specimens with a sheet of hard material, 1 mm \pm 0,1 mm thick, fitted around the supporting frame (fig. 19)	OK	P
	Covers, cover-plates or actuating members not come off	OK	P
	After the test: no damage	OK	P
20.4.2	Verification of the removal of covers, cover-plates or actuating members		
	Force not exceeding 120 N applied 10 times in direction perpendicular to the mounting / supporting surface: covers, cover-plates or actuating members come off	-	N/A
	Test repeated on new specimens with a sheet of hard material, 1 mm \pm 0,1 mm thick, fitted around the supporting frame (fig. 19)	-	N/A
	Covers, cover-plates or actuating members come off	-	N/A
	After the test: no damage	-	N/A
20.7	Test with gauge of figure 20 applied according to figure 21 for verification of the outline of covers, cover-plates or actuating members: distances between face C of gauge and outline of side under test, not decrease	Complying / not complying	—
20.8	Test with gauge according to figure 23 applied as shown in figure 24 (1 N): gauge not enter more than 1mm	Complying / not complying	—
20.9	Operating members of cord-operated switch have adequate strength	-	N/A
	Pull test: pull 100 N for 1 min (normal use); pull of 50 N for 1 min (unfavourable direction). After the test:		
	- switch show no damage	-	N/A
	- operating member not broken and cord-operated switch still operate	-	N/A
21	RESISTANCE TO HEAT		
21.1	Switches kept for 1 h in a heating cabinet at a temperature of 100 °C \pm 2 °C		
	During the test: no change impairing their further use and sealing compound, if any, not flow	OK	P
	After the test: no access to live parts, markings still legible	OK	P

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Clause	Requirement + Test	Result - Remark	Verdict
21.2	Parts of insulating material necessary to retain current-carrying parts and parts of the earthing circuit in position: ball-pressure test (1 h, 125 °C)	See appended table 21.2	P
21.3	Parts of insulating material not necessary to retain current-carrying parts and parts of the earthing circuit in position, even though in contact with them: ball-pressure test (1 h)	See appended table 21.3	P

22	SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS		
22.1	Connections withstand mechanical stresses	OK	P
	Thread-forming or thread-cutting screws used only if supplied together with the piece in which they are intended to be inserted	-	N/A
	Screws and nuts which transmit contact pressure: in engagement with a metal thread	OK	P
	Threaded part torque test	OK	P
22.2	Screws in engagement with a thread of insulating material: correct introduction into the screw hole or nut ensured	-	N/A
22.3	Contact pressure: not transmitted through insulating material other than ceramic, pure mica or other material no less suitable unless there is sufficient resiliency in metallic parts	OK	P
22.4	Screws and rivets locked against loosening or turning	OK	P
22.5	Current-carrying parts of metal having mechanical strength, electrical conductivity and resistance to corrosion adequate:		
	- copper;	-	N/A
	- alloy with at least 58 % copper for parts made from cold-rolled sheet or with at least 50 % copper for other parts;	> 58%	P
	- stainless steel with at least 13 % chromium and not more than 0,12 % carbon	-	N/A
	- steel with electroplated coating of zinc (ISO 2081): service condition ISO no. (1/2/3); IP (X0/X4/X5); thickness (µm)	-	N/A
	- steel with electroplated coating of nickel and chromium (ISO 1456): service condition ISO no. (2/3/4); IP (X0/X4/X5); thickness (µm)	-	N/A
	- steel with electroplated coating of tin (ISO 2093): service condition ISO no. (2/3/4); IP (X0/X4/X5); thickness (µm)	-	N/A
	Current-carrying parts subjected to mechanical wear: not of steel with electroplated coating	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Metals having a great difference of electrochemical potential: not used in contact with each other	-	N/A
22.6	Contacts subjected to sliding action: of metal resistant to corrosion	OK	P
22.7	Thread-forming screws and thread-cutting screws not used for the connection of current-carrying parts	OK	P
	Thread-forming screws and thread-cutting screws used to provide earthing continuity: not necessary to disturb the connection and at least two screws are used for each connection	-	N/A
23	CREEPAGE DISTANCES, CLEARANCES AND DISTANCES THROUGH SEALING COMPOUND		
23.1	Creepage distances, clearances and distances through sealing compound no less than the values shown in table 20	See appended table 23.1	P
23.2	Insulating compound: not protrude above the edge of the cavity in which it is contained	-	N/A
24	RESISTANCE OF INSULATING MATERIAL TO ABNORMAL HEAT, TO FIRE AND TO TRACKING		
24.1	Parts of insulating material which might be exposed to thermal stresses due to electric effects and the deterioration of which might impair the safety are not unduly affected by abnormal heat and fire	OK	P
24.1.1	Glow-wire test according to IEC 60695-2-1	See appended table 24.1.1	P
24.2	Parts of insulating material retaining live parts in position of switches with IP>X0: of material resistant to tracking	-	N/A
	Tracking test with solution A of IEC 60112	-	N/A
25	RESISTANCE TO RUSTING		
	Ferrous parts protected against rusting	OK	P
	Test: 10 min in carbontetrachloride, trichloroethane or equivalent degreasing agent, 10 min 10 % solution of ammonium chloride, 10 min in a box with air saturated with moisture and 10 min at 100 °C ± 5 °C:		
	No signs of rust	OK	P
26	EMC REQUIREMENTS		
26.1	Immunity		
	No immunity tests necessary	OK	P
26.2	Emission		
	No emission tests necessary	OK	P

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Clause	Requirement + Test	Result - Remark	Verdict

12.2.5	TABLE: test with apparatus shown in figure 10 (screw terminals)			P
	rated current (A)	-		—
	type of conductors	rigid solid / rigid stranded		—
	smallest/largest cross-sectional area per table 2 (mm ²)	1,0 / 2,5		—
	number of conductors	1		—
	nominal diameter of thread (mm); torque per table 3 (Nm)	3,0; 0,5		—
Cross-sectional area (mm ²)	Diameter of bushing hole per table 4 (mm)	Height H per table 4 (mm)	Mass (kg)	Remarks
1,0	6,5	260	0,4	OK
2,5	6,5	260	0,4	OK
supplementary information:				

12.2.6	TABLE: pull test (screw terminals)			P
	rated current (A)	-		—
	smallest/largest cross-sectional area per table 2 (mm ²)	1,0 / 2,5		—
	nominal diameter of thread (mm); torque 2/3 per table 3 (Nm)	3,0; 0,34		—
Cross-sectional area (mm ²)	Number of conductors	Type of conductors (rigid solid / rigid stranded)	Pull per table 5 applied for 1 min (N)	Remarks
1,0	1	1 X 1,13 / 7 x 0,42	50	OK
2,5	1	1 X 1,78 / 7 X 0,67	50	OK
supplementary information:				

12.2.7	TABLE: tightening test (screw terminals)				P
	rated current (A)		-		—
	nominal diameter of thread (mm); torque 2/3 per table 3 (Nm)		3,0; 0,34		—
Largest cross-sectional area per table 2 (mm ²)	Permissible number of conductors	Type of conductors (rigid solid / rigid stranded)	Number of wires and nominal diameter of wires per table 6	Remarks	
2,5	1	rigid solid / rigid stranded	1 X 1,78 / 7 X 0,67	OK	
supplementary information:					

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Clause	Requirement + Test	Result - Remark	Verdict

12.3.10	TABLE: mechanical stresses occurring in normal use (screwless terminals)			N/A
	rated current (A)	-		—
	largest/smallest cross-sectional area per table 7 (mm ²)	-		—
Number of connection (after that conductor subjected to a pull of 30 N for 1 min) / disconnection		Type of conductor (solid / rigid stranded / flexible)	Cross-sectional area (mm ²)	Remarks
-		-	-	-
-		-	-	-
	TABLE: test with apparatus shown in figure 10			N/A
	rated current (A)	-		—
	type of conductors	rigid solid / rigid stranded		—
	smallest/largest cross-sectional area per table 7 (mm ²)	-		—
	number of conductors	-		—
Cross-sectional area (mm ²)	Diameter of bushing hole per table 4 (mm)	Height H per table 4 (mm)	Mass (kg)	Remarks
-	-	-	-	-
-	-	-	-	-
supplementary information:				

12.3.11	TABLE: electrical and thermal stresses occurring in normal use			N/A
Test a)	Test carried out for 1 h connecting rigid solid conductors:			N/A
	test current per table 8 (A)	-		—
	nominal cross-sectional area (mm ²)	-		—
	Screwless terminal number	Voltage drop (mV)	Required voltage drop	
	1	-	≤ 15 mV	
	2	-	≤ 15 mV	
	3	-	≤ 15 mV	
	4	-	≤ 15 mV	
	5	-	≤ 15 mV	
Test b)	Temperature cycles test) carried out on terminals subjected to Test a):			N/A
	test current per table 8 (A)	-		—
	nominal cross-sectional area (mm ²)	-		—
	allowed voltage drop (mV)	≤ 22,5 mV or 2 times 24 th cycle value (mV)		—

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Clause	Requirement + Test	Result - Remark	Verdict

Screwless terminal number	1	2	3	4	5	Remarks
voltage drop after 24 th cycle	-	-	-	-	-	-
voltage drop after 48 th cycle	-	-	-	-	-	-
voltage drop after 72 th cycle	-	-	-	-	-	-
voltage drop after 96 th cycle	-	-	-	-	-	-
voltage drop after 120 th cycle	-	-	-	-	-	-
voltage drop after 144 th cycle	-	-	-	-	-	-
voltage drop after 168 th cycle	-	-	-	-	-	-
voltage drop after 192 th cycle	-	-	-	-	-	-

12.3.10	TABLE: mechanical stresses occurring in normal use				N/A
	rated current (A)	-			—
	largest/smallest cross-sectional area per table 7 (mm ²)	-			—
	Number of connection (after that conductor subjected to a pull of 30 N for 1 min) / disconnection	Type of conductor (solid / rigid stranded / flexible)	Cross-sectional area (mm ²)	Remarks	
	-	-	-	-	
	-	-	-	-	
	TABLE: test with apparatus shown in figure 10				N/A
	rated current (A)	-			—
	type of conductors	rigid solid / rigid stranded			—
	smallest/largest cross-sectional area per table 7 (mm ²)	-			—
	number of conductors	-			—
	Cross-sectional area (mm ²)	Diameter of bushing hole per table 4 (mm)	Height H per table 4 (mm)	Mass (kg)	Remarks
	-	-	-	-	-
	-	-	-	-	-
supplementary information:					

12.3.12	TABLE: deflection test (principle of test apparatus shown in figure 11a)				N/A
	Test carried out for 1 h connecting rigid solid conductors:				N/A
	test current (A) (equal rated current)	-			—
	required voltage drop (mV)	≤ 25 mV			—

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Clause	Requirement + Test	Result - Remark	Verdict

Type of conductor	Smallest			Largest			Remarks
cross-sectional area per table 9 (mm ²)	-			-			-
force per table 10 (N)	-			-			-
screwless terminal number	1	2	3	1	2	3	-
starting point (X = deflection original point)	X	X+10°	X+20°	X	X+10°	X+20°	
voltage drop 1 st deflection (mV)	-	-	-	-	-	-	-
voltage drop 2 nd deflection (mV)	-	-	-	-	-	-	-
voltage drop 3 rd deflection (mV)	-	-	-	-	-	-	-
voltage drop 4 th deflection (mV)	-	-	-	-	-	-	-
voltage drop 5 th deflection (mV)	-	-	-	-	-	-	-
voltage drop 6 th deflection (mV)	-	-	-	-	-	-	-
voltage drop 7 th deflection (mV)	-	-	-	-	-	-	-
voltage drop 8 th deflection (mV)	-	-	-	-	-	-	-
voltage drop 9 th deflection (mV)	-	-	-	-	-	-	-
voltage drop 10 th deflection (mV)	-	-	-	-	-	-	-
voltage drop 11 th deflection (mV)	-	-	-	-	-	-	-
voltage drop 12 th deflection (mV)	-	-	-	-	-	-	-
supplementary information:							

16.1	TABLE: insulation resistance			P
Item per table 20	Test voltage applied between:	Measured (MΩ)	Required (MΩ)	
1)	between all poles connected together and the body, with the switch in the “on” position.....:	200 MΩ	≥ 5 MΩ	
2)	between each pole in turn and all other poles connected to the body, with the switch in the “on” position	200 MΩ	≥ 2 MΩ	
3)	between the terminals which are electrically connected together when the switch is in the “on” position, the switch being in the “off” position - normal/mini-gap construction.....:	-	-	

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Clause	Requirement + Test	Result - Remark	Verdict

4)	between metal parts of mechanism, when insulated from live parts, and: - live parts..... - metal foil in contact the surface of knob or similar actuating member.....	-	-
Supplementary information:			

16.2	TABLE: electric strength		P
	Rated voltage (V)	250	—
Item per table 20	Test voltage applied between:	Test voltage (V)	Flashover / breakdown (Yes/No)
1)	between all poles connected together and the body, with the switch in the “on” position.....	2000	No
2)	between each pole in turn and all other poles connected to the body, with the switch in the “on” position	2000	No
3)	between the terminals which are electrically connected together when the switch is in the “on” position, the switch being in the “off” position - normal/mini-gap construction.....	-	N/A
4)	between metal parts of mechanism, when insulated from live parts, and: - live parts..... - metal foil in contact the surface of knob or similar actuating member.....	-	N/A
Supplementary information:			

17	TABLE: temperature rise measurements		N/A
	Rated current (A)	-	—
	Nominal cross-sectional area (mm ²)	-	—
	Terminal screws: torque (Nm) (2/3 table 3)	-	—
	Test current per table 15 passed for 1 h (A)	-	—
	Rated voltage of pilot light (V)	-	—
	Samples number	-	—
Thermocouple locations		max. measured temperature rise (K)	allowed temperature rise (K)
Temperature rise of the terminals.....		-	≤ 45

IEC 60669-1			
Clause	Requirement + Test	Result - Remark	Verdict

Temperature rise of parts of insulating material not necessary to retain current-carrying parts and parts of the earthing circuit in position	-	≤ 45
Supplementary information:		

19.1	TABLE: reduced electric strength after normal operation (clause 19.1)		N/A
Item per table 20	Test voltage applied between:	Test voltage (V)	Flashover / breakdown (Yes/No)
1)	Between all poles connected together and the body, with the switch in the "on" position.....:	1500	No
2)	Between each pole in turn and all other poles connected to the body, with the switch in the "on" position	1500	No
3)	Between the terminals which are electrically connected together when the switch is in the "on" position, the switch being in the "off" position - normal/mini-gap construction.....:	-	N/A
4)	between metal parts of mechanism, when insulated from live parts, and: - live parts.....: - metal foil in contact the surface of knob or similar actuating member.....:	-	N/A
	TABLE: temperature rise measurements at terminals after normal operation (clause 19.1)		N/A
	Test current (In) passed for 1 h (A).....:	-	—
Thermocouple locations		Max. measured temperature rise (K)	Allowed temperature rise (K)
Temperature rise of the terminals.....:		-	45
Supplementary information:			

19.2	TABLE: temperature rise measurements at terminals after test with fluorescent lamp load (clause 19.2)		N/A
	Test current (In) passed for 1 h (A).....:	-	—
Thermocouple locations		Max. measured temperature rise (K)	Allowed temperature rise (K)
Temperature rise of the terminals.....:		-	45
Supplementary information:			

IEC 60669-1			
Clause	Requirement + Test	Result - Remark	Verdict

20.1	TABLE: impact test			P
	Part of enclosure tested per table 18 (A, B, C, D)	Blows per part	Height of fall (mm)	Comments
	D	5	200	Pass
Supplementary information:				

21.2	TABLE: ball pressure test of thermoplastic materials			P
	Allowed impression diameter (mm) : ≤ 2 mm			—
	Part under test	Material designation / manufacturer	Test temperature (°C)	Impression diameter (mm)
	Switch base	See CDF	125	0,8
Supplementary information:				

21.3	TABLE: ball pressure test of thermoplastic materials			P
	Allowed impression diameter (mm) : ≤ 2 mm			—
	Part under test	Material designation / manufacturer	Test temperature (°C) ⁽¹⁾	Impression diameter (mm)
	Frame	See CDF	70	0,6
	Cover for USB port	See CDF	70	0,5
Supplementary information: ⁽¹⁾ 70 °C / 40 °C + highest temperature rise determined during the test of clause 17				

22.1	TABLE: threaded part torque test					P
	threaded part identification	diameter of thread (mm)	column number (I, II, or III)	applied torque (Nm)	times (5/10)	no damage
	Screw which is used to fixed switch base	3,0	III	0,5	5	OK
supplementary information:						

23.1	TABLE: creepage distances, clearances and distances through sealing compound							P
	Rated voltage (V) : 250							—
	Item per table 20	Creepage distance dcr, clearance cl and distance through sealing compound dtsc at/of:	Required cl (mm)	cl (mm)	Required dcr (mm)	dcr (mm)	Required dtsc (mm)	dtsc (mm)
	1) / 6)	Between live parts which are separated when the contacts are open.....:	≥ 3	4,5	≥ 3	> 3,0 (by gauge)	-	-

IEC 60669-1							
Clause	Requirement + Test			Result - Remark			Verdict
2) / 7)	Between live parts of different polarity	≥ 3	4,5	≥ 3	> 3,0 (by gauge) 2,0	-	-
	Between the lead wires in the pinch of a neon lamp with external resistor.....	≥ 1	2,0	≥ 1			
3) / 8)	Between live parts and accessible surfaces of parts of insulating material.....	≥ 3	-	≥ 3	-	-	-
	Between live parts and screws or devices for fixing bases, covers or cover-plates.....	≥ 3	> 4,0 (by gauge)	≥ 3	> 6,0 (by gauge)	-	-
Supplementary information:							

24.1.1	TABLE: glow-wire test			P
Part under test		Material designation / manufacturer	Test temperature (°C)	Remarks
Cover for USB port		See CDF	650	OK
Frame		See CDF	650	OK
Base		See CDF	850	OK
Supplementary information:				

24.2	TABLE: resistance to tracking			N/A	
	number of drops	50	—		
part under test		material designation / manufacturer		test voltage (V)	flashover / breakdown (Yes/No)
-		-		175	-
supplementary information:					

IEC 60669-1 ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict

<p align="center">ATTACHMENT TO TEST REPORT IEC 60669-1 EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES Switches for household and similar fixed-electrical installations Part 1: General requirements</p>			
Differences according: EN 60669-1:1999 + A1:2002 + A2:2008			
Attachment Form No.: EU_GD_IEC60669_1D			
Attachment Form Originator: IMQ S.p.A.			
Master Attachment Form: 2009-03			
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Clause	Requirement + Test	Result - Remark	Verdict
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	CENELEC COMMON MODIFICATIONS (EN)		
8	MARKING		P
8.1 (Annex B)	Paragraph added at the end of this subclause:		N/A
	Flexible cable outlet switches: information of minimum and maximum sizes for which the anchorage is provided put on the switch and/or the packaging unit	-	N/A
8.3	First sentence of last paragraph before note 2 replaced by:		P
	Marking is clearly visible with normal or corrected vision, without additional magnification, marked either on the front of the switch or on the inner part of its associated enclosure, or on the main part of the switch so that it is easy legible during installation	OK	P
8.6	First sentence of the first paragraph replaced by:		N/A
	Switches of pattern numbers 2, 3, 03 and switches with $V_n > 250\text{ V}$ and $I_n > 16\text{ A}$ if marked to indicate the switch position: direction of movement of the actuating member to its different positions or the actual switch position, clearly indicated	-	N/A
8.8	Note 2 changed into a requirement and its first sentence replaced by:		N/A
	Special precautions necessary to take when installing the switch: details of these and clear information given in an instruction sheet which accompanies the switch	-	N/A
9	CHECKING OF DIMENSIONS		N/A
	Paragraph added after the first paragraph:		N/A

IEC 60669-1 ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
	Type of boxes in which switches are to be mounted: specified in the manufacturer's catalogue	-	N/A
10	PROTECTION AGAINST ELECTRIC SHOCK		P
10.1	Additional requirement (IEC 60669-1/A1) concerning switches designed to be fitted with pilot lights supplied at voltage other than ELV is deleted	OK	P
10.3	First two line replaced by the following:		P
	Accessible parts of switches are made of insulating material	OK	P
	"cover or cover plates" replaced by "cover, cover plates and other parts of the enclosure"	OK	P
10.3.1	Replaced by:	-	N/A
	Metal covers, cover plates or other parts of enclosure protected by supplementary insulation made by insulating linings or insulating barriers	-	N/A
	Insulating linings or insulating barriers:	-	N/A
	- cannot be removed without being permanently damaged, or designed that	-	N/A
	- cannot be replaced in an incorrect position; if they are omitted, accessories are rendered inoperable or manifestly incomplete; there is no risk of accidental contact between live parts and metal covers or cover plates; precautions are taken to prevent creepage distances or clearances becoming less than the values specified in clause 23	-	N/A
10.3.2	Replaced by:	-	N/A
	Earthing of metal covers, cover plates or other parts of enclosure: connection of low resistance	-	N/A
11	PROVISION FOR EARTHING		P
11.1	Notes 1 and 2 changed into requirements:		N/A
	Requirement did not apply to the metal cover plates mentioned in 10.3.1	-	N/A
	Small screws and the like, isolated from live parts, for fixing bases, covers or cover plates, were not considered as accessible parts which can become live in the event of an insulation fault	-	N/A
11.2	Second paragraph replaced by:		N/A
	Earthing terminals have a capacity not less than that of the corresponding terminals for the supply conductors	-	N/A

IEC 60669-1 ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
12	TERMINALS		P
12.2.4	Second paragraph replaced by:		P
	Terminals the body of which is made of materials as detailed in 22.5 considered as complying with the requirement	OK	P
12.2.5	Paragraph before note 4 deleted	OK	P
12.2.6	"in case where they exist in the relevant IEC standard" in the last paragraph replaced by "if any, according to HD 21.3	OK	P
12.3.1	Present note numbered as note 1 and added new note 2:		N/A
	Tests of 12.3.12 carried out using rigid solid conductors only	-	N/A
13	CONSTRUCTIONAL REQUIREMENTS		N/A
13.16 (Annex B)	First paragraph replaced by:		N/A
	Flexible cable outlet switches: flexible cable (60245 IEC 66, 60227 IEC 52 or 60227 IEC 53, or as specified by the manufacturer) enter the switch through a suitable hole, groove or gland :	-	N/A
	Last but one paragraph replaced:		N/A
	An a.c. voltage of 2000 V applied for 1 min between the conductors and any metal clamp of the cord anchorage		N/A
	During the test: insulation of flexible cable not damaged (no breakdown or flashover)	-	N/A
	Subclause added at the end:		N/A
	Flexible cable outlet switches:		N/A
	- clear how relief from strain and prevention of twisting is intended to be effected	-	N/A
	- cord anchorage, or at least part of it, integral with or permanently fixed to one of the component parts of the switch	-	N/A
	- makeshift methods not used	-	N/A
	- cord anchorages suitable for different type of flexible cables	-	N/A
	Rewirable switches with earthing connection are designed with ample space for slack of the earthing conductor	-	N/A
22	SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS		P
22.1	Second sentence of the second paragraph deleted	OK	P

IEC 60669-1 ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
23	CREEPAGE DISTANCES, CLEARANCES AND DISTANCES THROUGH SEALING COMPOUND		P
23.3	Subclause added:		P
	Ordinary surface-type switches do not have bare current-carrying strips at the back	OK	P
24	RESISTANCE OF INSULATING MATERIAL TO ABNORMAL HEAT, TO FIRE AND TO TRACKING		P
24.1.1	Item b) replaced by:		P
	Parts of insulating material not necessary to retain current-carrying parts and parts of the earthing circuit in position, even though they are in contact with them, and parts of insulating materials necessary to hold in position the earthing terminal in an enclosure, by the test made at a temperature of 650 °C	OK	P
ZB	ANNEX ZB, SPECIAL NATIONAL CONDITIONS		P
7.1.7	BELGIUM, CZECH REPUBLIC, FINLAND, GERMANY, NETHERLANDS, NORWAY, SWEDEN: design B not used due to installation practice	-	N/A
8.1	DENMARK: symbol for earth for any space provided for an earthing terminal	-	N/A
	UNITED KINGDOM: marking of type reference not used	OK	P
8.3	UNITED KINGDOM: marking of type reference not used	OK	P
10.2	DENMARK, NORWAY: accessories requiring earth connection cannot normally be used due to the lack of an earthing conductor in many existing old buildings	-	N/A
10.3	DENMARK: enclosures, including covers and cover plates, may be made of metal:		N/A
	- for ordinary switches which comply with 10.3.1	-	N/A
	- for switches with IP>X0 which fulfil with 10.3.1 or 10.3.2	-	N/A
10.3.2	DENMARK, NORWAY: accessories requiring earth connection cannot normally be used due to the lack of an earthing conductor in many existing old buildings	-	N/A



IEC 60669-1 ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
10.5	DENMARK, NORWAY: accessories requiring earth connection cannot normally be used due to the lack of an earthing conductor in many existing old buildings	-	N/A
12.2.5	DENMARK, FINLAND, NORWAY, SWEDEN: - additional test with rigid solid conductors (if exist in relevant IEC standard), if the first test has been made with rigid stranded conductors	OK	P
	- in the case rigid stranded conductors do not exist, the test may be made with rigid solid conductors only	OK	P
12.2.6	DENMARK, FINLAND, NORWAY, SWEDEN: additional test with one rigid solid conductor and one rigid stranded conductor with same cross-sectional areas connected at same time is required for terminals allowing the connection of two conductors	-	N/A
13.15.2	DENMARK, FINLAND, NORWAY, SWEDEN, SWITZERLAND: sub-clause mandatory	-	N/A
ZC	ANNEX ZC, A-DEVIATIONS		P
11.2	BELGIUM: earthing terminals have a capacity not less than that of corresponding terminals for the supply conductors except that any additional external earthing terminal shall be of a size suitable for conductors of at least 4 mm ²	OK	P




TEST REPORT IEC 61558-2-16 Safety of power transformers, power supplies, reactors and similar products for supply voltages up to 1100 V Part 2: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units	
Report Number	70.410.12.1009.02-01
Date of issue	2016-06-22
Total number of pages.....	92
Applicant's name.....	Lumi Legend Electrical Co., Ltd.
Address	No. 18, Lane 239, Beihai Road, Jiangbei 315032 Ningbo PEOPLE'S REPUBLIC OF CHINA
Test specification:	
Standard	IEC 61558-2-16:2009 (First Edition) + A1:2013 (see also EN 61558-2-16:2009/A1:2013) used in conjunction with IEC 61558-1 (Second Edition) + A1:2009 (see also EN61558-1:2005+A1:2009)
Test procedure	N/A
Non-standard test method.....	N/A
Test Report Form No.....	IEC61558_2_16B
Test Report Form(s) Originator	VDE Testing and Certification Institute
Master TRF.....	Dated 2014-03
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General disclaimer:	
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




Test item description	Switches for household and similar fixed el. Installations, Wall USB charger	
Trade Mark	<i>lumitek</i>	
Manufacturer.....	Same as applicant	
Model/Type reference	LM60044, LB60044 (for end product)	
Ratings	Input: 100-250V~ 50/60Hz;	
Testing procedure and testing location:		
<input checked="" type="checkbox"/>	Testing Laboratory:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shang- hai Branch
Testing location/ address		No. 1999, Duhui Road, Shanghai, 201108, P. R. China
<input type="checkbox"/>	Associated Testing Laboratory:	
Testing location/ address		
Tested by (name + signature)		Jie ZHU
Approved by (name + signature)		Yi ZHU
<input type="checkbox"/>	Testing procedure: TMP/CTF Stage 1:	
Testing location/ address		
Tested by (name + signature)		
Approved by (name + signature)		
<input type="checkbox"/>	Testing procedure: WMT/CTF Stage 2:	
Testing location/ address		
Tested by (name + signature)		
Witnessed by (name + signature)		
Approved by (name + signature)		
<input type="checkbox"/>	Testing procedure: SMT/CTF Stage 3 or 4:	
Testing location/ address		
Tested by (name + signature)		
Witnessed by (name + signature)		
Approved by (name + signature)		
Supervised by (name + signature)		













List of Attachments (including a total number of pages in each attachment): <ul style="list-style-type: none"> • Test report IEC 61558-2-16:2009/A1:2013 used in conjunction with IEC 61558-1/A1:2009 (94 pages) 	
Summary of testing:	
Tests performed (name of test and test clause): <ol style="list-style-type: none"> 1. Complete tests on basic model LM60044. The other models for construction check only. 2. Requirements of EN60669-1/A2:2008 are also taken into consideration 3. Determination of the test result includes consideration of measurement uncertainty from the test equipment and methods. 4. We conclude that the product presented in this test report comply with the standard according to the test results on the submitted samples. 5. These test results comply with the requirements of EN 61558-2-16:2009/A1:2013 and EN 61558-1:2005+A1:2009 	Testing location: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No. 1999, Duhui Road, Shanghai, 201108, P. R. China
Summary of compliance with National Differences:	
List of countries addressed <p><input checked="" type="checkbox"/> The product fulfils the requirements of European standard EN 61558-2-16:2009/A1:2013 and EN 61558-1:2005+A1:2009.</p>	
Copy of marking plate: <p>See Data form for electrical equipment and machinery.</p>	

Test item particulars	
Classification of installation and use	Built in
Supply Connection	N/A
Type of transformers	Non-inherently Short-circuit-proof safety isolating transformer
Protection against electric shock	Class II
Short-circuit protection	Yes
inherently short-circuit proof	Yes / No
non-inherently short-circuit proof	Yes / No
non short-circuit proof	Yes / No
fail safe	Yes / No
Protection index	IP20
Other characteristics	N/A
Rated ambient temperature ta (°C)	25 °C
Short-circuit voltage (V)	N/A
Possible test case verdicts:	
- test case does not apply to the test object: N/A	
- test object does meet the requirement: P (Pass)	
- test object does not meet the requirement: F (Fail)	
Testing	
Date of receipt of test item	2012-09-19; 2016-04-19
Date (s) of performance of tests	2012-09-19 to 2012-11-19; 2016-04-20 to 2016-06-17
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC 60335-1:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies): Same as applicant	
General product information:	
The models LM60044 and LB60044 are similar to each other, except the shape of front panel. These products are wall mounted.	

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
8	MARKING AND OTHER INFORMATION		P
8.1	Transformer marked with:		P
	a) rated supply voltage or voltage range (V):	100-250V~	P
	b) rated output voltage (V):	5VDC	P
	c) rated output (VA, kVA or W):		N/A
	d) rated output current (A):	2,1A (two ways max.)	P
	e) rated frequency (Hz):	50/60Hz	P
	f) rated power factor (if not 1):		N/A
	g) symbol AC for alternating current, or DC for direct current-output		N/A
	h) symbol for electrical function (according to one or more part's 2) in addition with the symbol for SMPS (IEC 61558-2-16:09)	For example: 	P
	i) manufacturer's name or trademark or name of the responsible vendor	See page 2	P
	j) model or type reference	LM60044, LB60044	P
	k) vector group according to IEC 60076 for three-phase transformer		N/A
	l) symbol for Class II		P
	m) symbol for Class III		N/A
	n) index IPXX if other than IP00	IP20	P
	o) rated max. ambient temperature ta (if not 25 °C):		N/A
	p) rated minimum ambient temperature ta min, if <10° C and if a temperature sensitive device is used		N/A
	q) short-time duty cycle: operating time Intermittent duty cycle: operating and resting time (e.g. 5min/30min)		N/A
	r) for tw-marked transformers marked with the rated max. operating temperature, increased by multiples of 5 (e.g. tw 120; tw 125)		N/A
	s) transformers used with forced air cooling shall be marked with "AF" in m/s		N/A
	t) Information from the manufacturer to the purchaser (data sheet) :		P
	– short-circuit voltage (% rated supply voltage) for stationary transformers > 1000 VA		N/A
	– electrical function of the transformer		P

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
8.2	Marking for transformers IP00 or for associated transformers: type and trademark, instruction sheets		N/A
8.3	Adjusted voltage easily and clearly discernible		N/A
8.4	For each tapping or winding: rated output voltage and rated output		N/A
	necessary connections clearly indicated		N/A
8.5	For short-circuit proof transformers or non-inherently short-circuit proof transformers:		N/A
	Rated current (A or mA) and symbol for time current characteristics of the fuses for non-inherently short-circuit proof transformer with incorporated fuses and non-short-circuit proof transformer	F	N/A
	Manufacturer's model or type reference and rating of the device for non-inherently short-circuit proof transformers with incorporated replaceable protective device (other than fuses)		N/A
	Construction sheet for transformers with replaceable protective device (other than fuses) information with information about the replacement.		N/A
8.6	Terminals for neutral: "N"		N/A
	Terminal for protective earth marked with earthing symbol		N/A
	Identification of input terminals: "PRI"		N/A
	Identification of output terminals: "SEC"		N/A
	Symbol for any point/terminal in connection with frame or core		N/A
8.7	Indication for correct connection		N/A
8.8	Instruction sheet for type X, Y, Z attachments		N/A
8.9	Transformer for indoor use shall be marked with the relevant symbol.		P
8.10	Symbol for Class II construction not confused with maker's name or trademark.		P
	Class II transformer with parts to be mounted – delivered with all parts for class II after mounting.		P
	Symbol for class II transformer placed on the part which provides class II.		P
8.11	Correct symbols:		P
	Volts	V	P
	Amperes	A (mA)	P
	Volt amperes (or volt-amperes reactive for reactors)	VA or (VAR)	N/A
	Watts	W	N/A
	Hertz	Hz	P

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	Input	PRI	N/A
	Output	SEC	N/A
	Direct current	d.c. (DC) or 	P
	Neutral	N	N/A
	Single-phase a.c.		N/A
	Three-phase a.c.	3 	N/A
	Three-phase and neutral a.c.	3/N 	N/A
	Power factor	$\cos \varphi$	N/A
	Class II construction		P
	Class III construction		N/A
	Fuse-link	F	N/A
	Rated max. ambient temperature	t_a	N/A
	Frame or core terminal		N/A
	Protective earth		N/A
	IP number	IP20	P
	Earth (ground for functional earth)		N/A
	For indoor use only		P
	tw5 YYY		N/A
	tw10 YYY		N/A
	twx YYY		N/A
	Additional Symbols (IEC 61558-2-16:09)		P
	SMPS incorporating a Fail-safe separating transformer	 ^F or  ^F	N/A
	SMPS incorporating a Non-short-circuit-proof separating transformer	 or 	N/A
	SMPS incorporating a Short-circuit-proof separating transformer (inherently or non-inherently)	 or 	N/A
	SMPS incorporating a Fail-safe isolating transformer	 ^F or  ^F	N/A
	SMPS incorporating a Non-short-circuit-proof isolating trans- former	 or 	N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	SMPS incorporating a Short-circuit-proof isolating transformer (inherently or non-inherently)	 or 	N/A
	SMPS incorporating a Fail-safe safety isolating transformer		N/A
	SMPS incorporating a Non-short-circuit-proof safety isolating transformer		N/A
	SMPS incorporating a Short-circuit-proof safety isolating transformer (inherently or non-inherently)		P
	SMPS incorporating a Fail-safe auto-transformer	 or 	N/A
	SMPS incorporating a Non-short-circuit proof auto-transformer	 or 	N/A
	SMPS incorporating a Short-circuit proof auto-transformer (inherently or non-inherently)	 or 	N/A
	SMPS (Switch mode power supply unit)		P
8.12	Figures, letters or other visual means for different positions of regulating devices and switches		N/A
	OFF position indicated by figure 0		N/A
	Greater output, input etc. indicated by higher figure		N/A
8.13	Marking not on screws or other easily removable parts		P
	Marking clearly discernible (transformer ready for use)		P
	Marking for terminals clearly discernible if necessary after removal of the cover		N/A
	Marking for terminals: no confusion between input and output		N/A
	Marking for interchangeable protective devices positioned adjacent to the base		N/A
	Marking for interchangeable protective devices clearly discernible after removal of cover and protective device		N/A
8.14	Special information for installation (in the catalogue, data sheet, or instruction sheet) if necessary:		N/A
	For non-inherently short-circuit proof transformers with non-self-resetting or non-replaceable devices (weak-point, thermal link): The device cannot be reset or replaced		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	For transformers generating a protective earth conductor current of 10 mA (see also cl. 18.5.2): The installation shall be made according to the wiring rules.		N/A
	For associated- and IP00-transformers: At 10% over or under voltage in the supply voltage, the rated output of the transformer shall be selected accordingly.		N/A
	For stationary transformers exceeding 1000 VA: The short circuit voltage in % of the rated voltage		N/A
	For all transformers the electrical function: An information about the electrical function of the transformer (e.g. inherently short circuit proof safety isolating transformer)		P
	For associated- and IP00-transformers: The max. abnormal winding temperature		N/A
	For tw-transformers: The specific constant S is (e.g. S6 says S = 6000)		N/A
	For transformers with more than one output winding, not for series or parallel connection		N/A
	– an information in the instruction sheet: the transformer is not intended for series/parallel connection		N/A
	For IP00-transformers the test of 27.2 is not performed. The result may be affected by the enclosure in the final application.		N/A
8.15	Marking durable and easily legible		P

9	PROTECTION AGAINST ELECTRIC SHOCK		P
9.1	Protection against contact with hazardous live parts		P
9.1.1	A live part is not a hazardous live part if:		P
	– it is separated from the supply by double or reinforced insulation		P
	– the requirements of 9.1.1.1 or 9.1.1.2 are fulfilled		P
9.1.1.1	The touch voltage is ≤ 35 V(peak) a.c. or ≤ 60 Vd.c.	output ≤ 60 Vd.c.	P
9.1.1.2	If the touch voltage is > 35 V (peak)a.c. or > 60 V d.c., the following requirements shall be fulfilled:		N/A
	The touch current shall not exceed:		N/A
	– for a.c. 0,7 mA (peak)		N/A
	– for d.c. 2,0 mA (see Annex J)		N/A
	In addition, when a capacitor is connected to live parts:		—

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Clause	Requirement + Test	Result - Remark	Verdict
9.1.1.2.1	discharge: < 45 C (between 60 V and 15 kV)		P
9.1.1.2.2	energy: ≤ 350 mJ (voltage >15 kV)		N/A
9.1.2	Transformers shall have an adequate protection against accessibility to hazardous live parts:		P
	The enclosure of class I and class II transformers gives an adequate protection against accidental contact with hazardous live parts.		P
	Class I transformers: accessible parts are separated from hazardous live parts by at least basic insulation.		N/A
	Class II transformers: no accessibility to basic insulation, or conductive parts separated from hazardous live parts by basic insulation.		P
	Hazardous live parts are not accessible after removal of detachable parts.		N/A
	Hazardous live parts are not accessible after removal of detachable parts except for:		N/A
	– lamps having caps larger B9 and E10		N/A
	– type D fuse holder		N/A
	Lacquers, enamel, paper, cotton, oxide film on metal parts not used for protection against accidental contact with hazardous live parts:		P
	Shafts, handles, operating levers, knobs are not hazardous live parts.		N/A
	Compliance is checked by inspection and by relevant tests according to IEC 60 529		P
	Class II transformers and Class II parts of Class I construction are tested with the test pin (fig. 3)		P
	Hazardous live parts shall not be touchable by test finger (fig. 2)		P
	for Class II transformers: metal parts separated by basic insulation from hazardous live parts not touchable by test finger		P
	hazardous live parts shall not be touchable with the test pin		P
9.1.3	Accessibility of non-hazardous live parts		P
	Non-hazardous live parts of the output circuit may be accessible if they are isolated from the input circuit by double or reinforced insulation and if the following conditions are fulfilled:		P
	– The no load output voltage is ≤ 35 V peak a.c. or ≤ 60 V ripple free d.c., both poles are accessible		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– The no load output voltage is > 35 V peak a.c. or > 60 V ripple free d.c. and ≤ 250 V a.c., only one pole may be accessible		N/A
9.2	Transformers with primary supply plug: 1 s after the interruption of the supply the voltage between the pins do not exceed 35 V (peak) a.c. or 60 V ripple free d.c.		N/A
	Transformers without a primary supply plug: 5 s after the interruption of the supply the voltage between the input terminals do not exceed 35 V (peak) a.c. or 60 V ripple free d.c.		N/A
	The following tests are required :		N/A
	If the nominal capacitance is ≤ 0,1 µF – no test is conducted.		N/A
	– 10 times switch the supply source on and off, or use a special equipment for to switch off at the most unfavourable electrical angle		N/A
	If the measured voltage is > 60 V ripple free d.c., the discharge must be ≤ 45 µC.		N/A

10	CHANGE OF INPUT VOLTAGE SETTING		P
	Voltage setting not possible to change without a tool		N/A
	Different rated supply voltages:		N/A
	– indication of voltage for which the transformer is set, is discernible on the transformer.		N/A
10.101	A wide range of the input (120 V a. c, to 240 V a.c voltage is allowed (IEC 61558-2-16:09):		P
	– if the output voltages does not exceed the rated output voltage		P
	– if the no-load voltage does not exceed the limits of output voltage deviation		P

11	OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD		P
11.1	Difference from rated value (without rectifier; with rectifier):		P
	a) inherently short-circuit proof transformers with one rated output voltage for output voltage: a.c. 10% ; d.c. 15%	(see appended table)	N/A
	b) inherently short-circuit proof transformers with one more than 1 rated output voltage for highest output voltage: a.c. 10%; d.c. 15%		N/A
	c) idem for other output voltages: a.c. 15%; d.c. 20%		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	d) other transformers for output voltages: a.c. 5%; d.c. 10%		P
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12	NO-LOAD OUTPUT VOLTAGE (see supplementary requirements in Part 2)		P
	Remark: with rectifier measuring on both sides of the rectifier		P
12.101	The no load output voltage shall not exceed (IEC 61558-2-16:09):		P
	– For SMPS incorporating separating or auto-transformers: 1000V a.c. or 1415 V ripple free d.c.		N/A
	– For SMPS including isolating transformers: 500 V a.c. or 708 V ripple-free d.c.		N/A
	– For SMPS including safety isolating transformers: 50 V a.c. or 120 V ripple-free d.c.	5,04Vd.c.	P
	For independent transformers , this output voltage limitation applies even when output windings, not for interconnection, are connected in series		N/A
12.102	The difference between output voltage at no load and the output voltage measured in clause 11 does not exceed the values of table 101 (IEC 61558-2-16:2009), Rated output (VA) Rated value %		P

13	SHORT-CIRCUIT VOLTAGE		N/A
	Difference from marking for short-circuit voltage 20%		N/A

14	HEATING		P
14.1	General requirements		P
	No excessive temperature in normal use		P
	Room temperature: rated ambient temperature $t_a \pm 5^\circ\text{C}$		—
	Type X, Y, Z attachments: 1 pull (5 N) to the connection windings		N/A
	Upri (V): 1,1 times rated supply voltage loaded with rated impedance – for independent transformers	1,1x250V=275V	—
	Upri (V): 1,1 times rated supply voltage: with I sec (A), measured with rated impedance and 1,0 times of the rated supply voltage for others than independent transformers		—
	Type X, Y, Z attachments: 1 pull (5 N) to the connection windings		N/A
	Max. temperature windings	(see appended table)	P

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Clause	Requirement + Test	Result - Remark	Verdict
	– Class A: 100 C		N/A
	– Class E: 115 C		N/A
	– Class B: 120 C	Max.109,7	P
	– Class F: 140 C		N/A
	– Class H: 165 C		N/A
	– other classes		N/A
	Temperature of external enclosures of stationary transformers:		P
	– metal: 70 °C		N/A
	– other material: 80 °C	Max.45,4	P
	Temperature of external enclosure of stationary transformer 85 C (not touchable with the IEC test finger)	Max.71,5	P
	Temperature of external enclosures, handles, etc. of portable transformers:		N/A
	– continuously held parts of metal: 55 C		N/A
	– continuously held parts of other material: 75 C		N/A
	– not continuously held parts of metal: 60 C		N/A
	– not continuously held parts of other material: 80 C		N/A
	Temperature of terminals for external conductors 70 C		N/A
	Temperature of terminals of switches 70 C		N/A
	Temperature of internal and external wiring:	Max.74,3<105	P
	– rubber: 65 C		N/A
	– PVC: 70 C		N/A
	Temperature of parts where safety can be affected:		N/A
	– rubber: 75 C		N/A
	– phenol-formaldehyde: 105 C		N/A
	– urea-formaldehyde: 85 C		N/A
	– impregnated paper and fabric: 85 C		N/A
	– impregnated wood: 85 C		N/A
	– PVC, polystyrene and similar thermoplastic material: 65 C		N/A
	– varnished cambric: 75 C		N/A
	Temperature rise of supports 85 C	Max.71,5	P
	Temperature of printed boards:		P
	– bonded with phenol-formaldehyde: 105 C	Max.91,4	P

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Clause	Requirement + Test	Result - Remark	Verdict
	– melamine-formaldehyde: 105 °C		N/A
	– phenol-furfural: 105 °C		N/A
	– polyester: 105 °C		N/A
	– bonded with epoxy: 140 °C		N/A
	Electric strength between input and output windings (18.3, 1 min); test voltage (V)	4200V, 1min.	P
14.101	Winding temperature measured by thermocouples at the surface of the winding(IEC 61558-2-16:09)		P
	– if the internal frequencies is > 1kHz	61kHz	P
	– the values of Table 1 for windings temperatures are reduced by 10° C	Class B: ≤110 °C	P
14.2	Application of 14.1 or 14.3 according to the insulation system		P
14.2.1	Class of isolating system (classified materials according to IEC 60 085 and IEC 60 216)	Class B	P
14.2.2	No classified material, or system but the measured temperature does not exceed the value of Class A		N/A
14.2.3	No classified material or system but the measured temperature exceeds the value for Class A, the live parts of the transformers are submitted to the test of 14.3		N/A
14.3	Accelerated ageing test for undeclared class of isolating system		N/A
	Cycling test (10 cycles):		N/A
	– measuring of the no-load input current (mA)		N/A
14.3.1	– heat run (temperature in table 2)		N/A
14.3.2	– vibration test: 30 min; amplitude 0,35 mm; frequency range: 10 Hz, 55 Hz, 10 Hz		N/A
14.3.3	– moisture treatment (48 h, 17.2)		N/A
14.3.4	Measurements and tests at the beginning and after each test:		N/A
	– deviation of the no-load input current, measured at the beginning of the test is 30%		N/A
	– insulation resistance acc. cl.18.1 and 18.2		N/A
	– electric strength, no breakdown (18.3); 2 min; test voltage 35% of specified value (table VI)		N/A
	– Transformers (50 or 60 Hz version) are tested after the dielectric strength test as follows: under no load; duration: 5 min; Upri(V):1,2 times rated supply voltage; frequency (Hz): 2 times rated frequency		N/A

15	SHORT-CIRCUIT AND OVERLOAD PROTECTION	P
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IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
15.1	General		P
	Tests direct after 14.1 at the same t_a and without changing position.	(see appended table)	P
	Supply voltage between 0,9 times and 1,1 times of the rated supply voltage		—
	Transformer with rectifier tests of 15.2 and 15.3 at the input and the output terminals of the rectifier.		P
	Transformers with more than one output winding or tapping, all windings tested with normal load, the winding with the highest temperature is short circuited.		N/A
	Winding protected inherently (15.2)		N/A
	– Max. temperature of winding protected inherently (insulation class): 150 °C (A); 165 °C (E); 175 °C (B); 190 °C (F); 210 °C (H)		N/A
	Winding protected by protective device:		P
	– Test according 15.3.2 - 15.3.3 – 15.3.4: max. temperature of winding during the time required or the time T given in table 4 (a) (insulation class): 200 °C (A); 215 °C (E); 225 °C (B); 240 °C (F); 260 °C (H)		N/A
	– Test according 15.3.1: max. temperature of winding during the first hour, peak value (insulation class): 200 °C (A); 215 °C (E); 225 °C (B); 240 °C (F); 260 °C (H)	Max.56,3	P
	– Test according 15.3.1: max. temperature of winding after first hour, peak value (insulation class): 175 °C (A); 190 °C (E); 200 °C (B); 215 °C (F); 235 °C (H)	Max.56,3	P
	– Test according 15.3.1: max. temperature of winding after first hour, arithmetic mean value (insulation class): 150 °C (A); 165 °C (E); 175 °C (B); 190 °C (F); 210 °C (H)	Max.56,3	P
	Max. temperature of external enclosures (accessible by test finger) 105 °C	Max.47,9	P
	Max. temperature of insulation of wiring (rubber and PVC) 85 °C	Max.87,9(UL 105°C)	P
	Temperature rise of supports 105 °C	Max.87,9	P
15.2	For inherently short-circuit proof transformers and for transformers with rectifiers test by short circuit of the output winding at rated supply voltage x 1,1: temperature rises values in table 3		N/A
15.3	For non-inherently short-circuit proof transformers and for transformers with rectifiers: temperature rises values in table 3		P

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Clause	Requirement + Test	Result - Remark	Verdict
15.3.1	Output terminals short-circuited: protection device operates, test at 0,9 ... 1,1 of the rated supply voltage		P
15.3.2	If protected by a fuse accordance with either IEC 60 269-2 or IEC 60 269-3, or a technical equivalent fuse, the transformer is loaded as in table 4.		N/A
15.3.3	If protected by a fuse accordance with either IEC 60 127 or ISO 8820, or a technical equivalent fuse, the transformer is loaded with the current as specified for the longest pre arcing time. <i>If protected by a miniature fuses in accordance to IEC 60127, 1,5 times of the rated fuse, until steady state condition (in addition)</i>		N/A
15.3.4	If protected by a circuit-breaker according to IEC 60 898 the transformer is loaded with a current equal to 1,45 times the value of the circuit-breaker rated current		N/A
15.3.5	If other overload protection than a fuse (IEC 60 127) or a circuit-breaker (IEC 60 898) test with 0,95 times of operating current		P
	If an internal weak point is used, the test must be repeated with two new samples. The two additional samples works similar to the first sample. Temperatures in the limit of table 3		N/A
15.4	For non-short-circuit proof transformers: temperature rises values in table 3, tests as indicated in 15.3		N/A
15.5	For fail-safe transformers:		N/A
15.5.1	Three additional new specimens are used		—
	– Upri (V): 1,1 times rated supply voltage		—
	– Isec (A): 1,5 times rated output current		—
	– time until steady-state conditions t1 (h)		—
	– time until failure t2 (h): t1; 5 h		N/A
15.5.2	During the test:		N/A
	– no flames, molten material, etc.		N/A
	– temperature of enclosure 175 C		N/A
	– temperature of plywood support 125 C		N/A
	After the test:		N/A
	– electric strength (Cl. 18, 1 min, test voltage: 35% of specified value); no flashover or breakdown for primary-to-secondary only for safety isolating, isolating and separating transformer and for primary-to-body for all kinds of transformer		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– bare hazardous live parts not accessible by test finger through holes of enclosure		N/A
15.101	Electronic circuits of the SMPS fulfil the requirements of Annex H of part 1 . After a fault: no electric shock, no fire hazard and no unintentional operation.	(Details see Annex H)	P

16	MECHANICAL STRENGTH		P
16.1	General		P
	After tests of 16.2, 16.3 and 16.4		P
	– no damage		P
	– hazardous live parts not accessible by test pin according to 9.2		P
	– no damage for insulating barriers		P
	– handles, levers, etc. have not moved on shafts		N/A
16.2	Transformers (stationary and portable s. 16.1)		P
	For stationary and portable transformers: 3 blows, impact energy 0,5 Nm		P
16.3	Portable transformers (except of plug in transformers)		N/A
	For portable transformers: 100 falls, 25 mm		N/A
16.4	Transformers with integrated pins (plug in transformers), the following tests are carried out:		N/A
	a) plug-in transformers: tumbling barrel test: 50 x 250 g; 25 x 250 g		N/A
	b) torque test of the plug pins with 0,4 Nm		N/A
	c) pull force according to table 5 for each pin		N/A

17	PROTECTION AGAINST HARMFUL INGRESS OF WATER AND MOISTURE		P
17.1	Degree of protection (IP code marked on the transformer)	IP20	P
	Test according to 17.1.1 and for other IP ratings test according to IEC 60 529:		P
	– stable operating temperature before starting the test for < IPX8		N/A
	– transformer mounted and wired as in normal use		P
	– fixed transformer mounted as in normal use by the tests according to 17.1.1 A to L		P
	– portable transformers placed in the most unfavourable position and wired as in normal use		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– glands tightened with a torque equal to two-thirds of 25.6		N/A
	After the tests:		P
	– dielectric strength test according to 18.3		P
	Inspection:		N/A
	a) in dust-proof transformers no deposit of talcum powder		N/A
	b) no deposit of talcum powder inside dust-tight transformers		N/A
	c) no trace of water on live parts except SELV parts below 15 V ac or 25 V dc or insulation if hazard for the user or surroundings no reduction of creepage distances		N/A
	d) no accumulation of water in transformers IPX1 so as to impair safety		N/A
	e) no trace of water entered in any part of water-tight transformer		N/A
	f) no entry into the transformer by the relevant test probe		N/A
17.1.1	Tests on transformers with enclosure:		P
	A) Solid-object-proof transformers:		P
	- 2 IP2X test finger (IEC 60 529) and test pin (fig. 3)		P
	B) Solid-object-proof transformers:		N/A
	- wire 2,5 mm; force 3 N		N/A
	- IP4X, wire 1 mm; force 1 N		N/A
	C) Dust-proof transformers, IP5X; dust chamber according to IEC 60 529, fig. 2:		N/A
	a) transformer has operating temperature		N/A
	b) transformer, still operating, is placed in the dust chamber		N/A
	c) the door of the dust chamber is closed		N/A
	d) fan/blower is switched on		N/A
	e) after 1 min transformer is switched off for cooling time of 3 h		N/A
	A) Dust-tight transformers (IP6X) test according to C)		N/A
	B) Drip-proof transformers (IPX1) test according to fig. 3 of IEC 60 529 for 10 min		N/A
	C) Rain-proof transformers (IPX2) test according to fig. 3 of IEC 60 529 for 10 min in operation, any angle up to 15°		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	D) Spray proofed transformers (IPX3) test according to fig. 4 of IEC 60 529 for 10 min in operation and 10 min switched off , time for complete oscillation (2 x 120°) is 4 sec.		N/A
	E) Splash-proof transformers (IPX4) test according to fig. 4 of IEC 60 529 (see F) for 10 min in operation and 10 min switched off (the tube shall oscillate $\approx 360^\circ$)		N/A
	F) Jet-proof transformer (IPX5) test according to fig. 6 of IEC 60 529 (nozzle 6,3mm)		N/A
	G) Powerful Jet-proof transformer (IPX6) test according to fig. 6 of IEC 60 529 (nozzle 12 mm)		N/A
	H) Watertight transformers (IPX7)		N/A
	I) Pressure watertight transformers (IPX8)		N/A
17.2	After moisture test (48 h for IP20, 168 h for other transformers):	48 h	P
	– insulation resistance and electric strength (Cl. 18)		P

18	INSULATION RESISTANCE AND ELECTRIC STRENGTH		P
18.2	Insulation resistance between:		P
	– live parts and body for basic insulation 2 M		N/A
	– live parts and body for reinforced insulation 7 M		P
	– input circuits and output circuits for basic insulation 2 M		N/A
	– input circuits and output circuits for double or reinforced insulation 5 M		P
	– each input circuit and all other input circuits connected together 2 M		N/A
	– each output circuit and all other output circuits connected together 2 M		N/A
	– hazardous live parts and metal parts with basic insulation (Class II transformers) 2 M		N/A
	– body and metal parts with basic insulation (Class II transformers) 5 M		N/A
	– metal foil in contact with inner and outer surfaces of enclosures 2 M		N/A
18.3	Electric strength test (1 min): no flashover or breakdown:		P
	1) basic insulation between input circuits and output circuits; working voltage (V); test voltage (V) :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	2) double or reinforced insulation between input circuits and output circuits; working voltage (V); test voltage (V)	4200V	P
	3) basic or supplementary insulation between:		N/A
	a) live parts of different polarity; working voltage (V); test voltage (V)		N/A
	b) live parts and the body if intended to be connected to protective earth		N/A
	c) inlet bushings and cord guards and anchorages		N/A
	d) live parts and an intermediate conductive part		N/A
	e) intermediate conductive parts and body		N/A
	4) Reinforced insulation between the body and live parts; working voltage (V); test voltage (V) :	4200V	P
	5) Functional insulation for windings intended to be connected in series or parallel (test voltage = working voltage + 500 V) (IEC 61558-2-16:09)		N/A
18.4	Does not apply (IEC 61558-2-16:09)		-
18.101	Impulse test according Table F5 of IEC 60664-1 with 1,2/50 μ s (IEC 61558-2-16)		P
	– After the test of 18.3, 10 impulses of each polarity between input and output terminals		P
	– During the tests no breakdown of the insulation between turns of a winding, between input and output circuits, or between windings and any conductive core		P
18.102 (A1)	Partial discharge tests according to IEC 60664-1, if the working voltage is > 750 V peak		N/A
	Partial discharge is ≤ 10 pC at time P2 See Fig. 19.101		N/A
18.5	Touch current and protective earth current		P
18.5.1	Touch current		P
	Touch current measured after the clause 14 test (hot) for class I and class II transformers (class II transformers with metal foil at the plastic surface). The test circuit according figure 8. Measuring network according Figure J1 (Annex J). If the frequency is >30kHz, measuring across the 500 Ohm resistor of J1 (burn effects).		P
	Measurement of the touch current with switch p of picture 8 in both positions and in combination with switches e and n. The measured values are less than the required values of table 8b.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– switches n and e in on position		P
	– switch n: off and switch e: on		P
	– switch n: on and switch e: off		P
18.5.2	Protective earth conductor current		-
	The transformer is connected as in clause 14 Impedance of the ammeter < 0,5 Ohm, connected between earth terminal of the transformer and protective earth conductor		N/A
	The measured values are less than the required values of table 8b.		N/A

19	CONSTRUCTION		P
19.1	Separation of input and output circuits		P
19.1.1	SMPS incorporating auto-transformers (IEC 61558-2-16:2009)		N/A
19.1.1.1	For plug connected auto-transformers with rated input voltage > rated output voltage the potential to earth shall not exceed the rated output voltage. (IEC 61558-2-16:2009)		N/A
19.1.1.2	SMPS with polarised input and output plug and socket-outlet system: an instruction is given with the information, that the transformer shall not be used with non-polarised plug and socket outlet system. (IEC 61558-2-16:2009)		N/A
19.1.1.3	A polarity detecting device only energises the output in the case: output potential to earth \leq rated output voltage, also with reversed input plug. (IEC 61558-2-16:2009)		N/A
	– The contact separation of the device is \geq 3mm		N/A
	– A current to earth does not exceed 0,75 mA.		N/A
	– All tests are repeated under fault conditions of H.2.3 of annex H of part 1. The potential to earth does not exceed the max output voltage for more than 5 s.		N/A
19.1.2	SMPS incorporating separating transformers (IEC 61558-2-16:09)		N/A
19.1.2.1	Input and output circuits electrically separated. (IEC 61558-2-16:09)		N/A
19.1.2.2	The insulation between input and output winding(s) consist of basic insulation (IEC 61558-2-16:09)		N/A
	Class I SMPS		N/A
	– Insulation between input windings and body consist of basic insulation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– Insulation between output windings and body consist of basic insulation		N/A
	Class II SMPS (IEC 61558-2-16:2009)		N/A
	– Insulation between input windings and body consist of double or reinforced insulation		N/A
	– Insulation between output windings and body consist of double or reinforced insulation		N/A
19.1.2.3	The insulation between input windings and intermediate conductive parts and the output windings and intermediate part consist of basic insulation (IEC 61558-2-16:09)		N/A
	For class I SMPS the insulation between input and output windings via the intermediate conductive parts consist of basic insulation (IEC 61558-2-16:2009)		N/A
	For class II SMPS the insulation between input winding and the body and between the output windings and the body via the intermediate conductive parts consist of double or reinforced insulation. (IEC 61558-2-16:2009)		N/A
19.1.2.4	Parts of output circuits may be connected to protective earth (IEC 61558-2-16:09)		N/A
19.1.2.5	No direct contact between output circuits and the body, unless: (IEC 61558-2-16:2009)		N/A
	– Allowed for associated transformers by the equipment standard		N/A
	– Clause 19.8 of part 1 is fulfilled		N/A
19.1.3	SMPS incorporating isolating transformers and safety isolating transformers (IEC 61558-2-16:09)		P
19.1.3.1	Input and output circuits electrically separated (IEC 61558-2-16:09)		P
	No possibility of any connection between these circuits		P
19.1.3.2	The insulation between input and output winding(s) consist of double or reinforced insulation (exception see 19.1.3.4) (IEC 61558-2-16:09)		P
	Class I SMPS not intended for connection to the mains by a plug:		—
	– Insulation between input windings and body connected to earth consist of basic insulation rated to the input voltage		N/A
	– Insulation between output windings and body, connected to earth consist of basic insulation rated for the output voltage		N/A
	Class I SMPS intended for connection to the mains by a plug (EN 61558-2-16:09):		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– Insulation between input windings and body connected to earth consist of basic insulation rated to the working voltage		N/A
	– Insulation between output windings and body, connected to earth consist of supplementary insulation rated for the working voltage		N/A
	Class II SMPS (IEC 61558-2-16:2009)		P
	– Insulation between input windings and body consist of double or reinforced insulation rated to the input voltage		P
	– Insulation between output windings and body consist of double or reinforced insulation, rated to the output voltage		N/A
19.1.3.3	SMPS with intermediate conductive parts not connected to the body (between input/output) (EN 61558-2-16:09):	T1 core considered as pri. part	-
19.1.3.3.1	For class I and class II SMPS the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation, rated to the working voltage (EN 61558-2-16:09).		N/A
	– For class II SMPS the insulation between input winding and the body and between the output windings and the body via the intermediate conductive parts consist of double or reinforced insulation. (rated to the input voltage, for SELV circuits only basic insulation to the body)		N/A
	– For transformers, different from independent, the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation, rated to the working voltage.		N/A
19.1.3.3.2	Class I transformers with earthed core, and not allowed for class II equipment (EN 61558-2-16:09)		N/A
	– Insulation from the input to the earthed core: basic insulation rated for the input voltage		N/A
	– Insulation from the output voltage to the earthed core: basic insulation rated for the output voltage		N/A
19.1.3.3.3	Insulation between : input to intermediate conductive parts and output and intermediate parts consist of at least basic insulation (EN 61558-2-16:09)		N/A
	– If the insulation from input or output to the intermediate metal part is less than basic insulation, the part is considered to be connected to input or output.		N/A
19.1.3.4	For class I SMPS, with protective screen, not connected to the mains by a plug the following conditions comply (EN 61558-2-16:09):		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– The insulation between input winding and protective screen consist of basic insulation (rated input voltage)		N/A
	– The insulation between output winding and protective screen consist of basic insulation (rated output voltage)		N/A
	– The protective screen consist of metal foil or a wire wound screen extending the full width of the windings and has no gaps or holes		N/A
	– Where the protective screen does not cover the entire width of the input winding, additional insulation to ensure double insulation in this area, is used.		N/A
	– If the screen is made by a foil, the turns are isolated, overlap at least 3 mm		N/A
	– The cross-section of the screen and the lead out wire is at least corresponding to the rated current of the overload device		N/A
	– The lead out wire is soldered or fixed to the protective screen.		N/A
	Protective screening is not allowed for SMPS with plug connection to the mains (EN 61558-2-16:09)		N/A
19.1.3.5	No connection between output circuit and protective earth, except of associated transformers (allowed by equipment standard) or 19.8 is fulfilled (EN 61558-2-16:09).		N/A
19.1.3.6	No connection between output circuit and body, except of associated transformers (allowed by equipment standard) (EN 61558-2-16:09)		P
19.1.3.7	The distance between input and output terminals for the connection of external wiring is ≥ 25 mm		N/A
19.1.3.8	Portable SMPS having an rated output ≤ 630 VA (EN 61558-2-16:09)		N/A
19.1.3.9	No connection between output circuit and body except of associated transformers (allowed by equipment standard) (EN 61558-2-16:09)		P
19.1.3.10	Protective screening is not allowed for SMPS with plug connection to the mains (EN 61558-2-16:09)		P
19.2	Fiercely burning material not used		P
	Unimpregnated cotton, silk, paper and fibrous material not used as insulation		P
	Wax-impregnated, etc. not used		P
19.3	Portable transformer: short-circuit proof or fail-safe		N/A
19.4	Class II transformers: contact between accessible metal parts and conduits or metal sheaths of supply wiring impossible		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
19.5	Class II transformers: part of supplementary or reinforced insulation, during reassembly after routine servicing not omitted		P
19.6	Class I and II transformers: creepage distances and clearances over supplementary or reinforced insulation if wire, screw, nut, etc. become loose or fall out of position not 50% specified values (Cl. 26)		P
19.7	Conductive parts connected to accessible metal parts by resistors or capacitors shall be separated from hazardous live parts by double or reinforced insulation		N/A
19.8	Resistors or capacitors connected between hazardous live parts and the body (accessible metal parts) consist of:		P
	– components according to IEC 60 065, 14.1 or capacitor Y1 according to IEC 60 384-14		P
	– at least two separate components		N/A
	– if one component is short-circuited or opened, values specified in Cl. 9 shall not be exceeded		N/A
	– if the working voltage is ≤ 250 V, one Y1 capacitor according 60384-14 is allowed	234V; one Y1 capacitor used	P
19.9	Insulation material input/output and supplementary insulation of rubber resistant to ageing		N/A
	Creepage distances (if cracks) specified values (Cl. 26)		N/A
19.10	Protection against accidental contact by insulating coating:		N/A
	a) ageing test (section I, IEC 60 068-2-2), test Ba: 168 h; 70 °C		N/A
	b) impact test (spring-operated impact hammer according to IEC 60 068-2-63; $0,5 \pm 0,05$ J)		N/A
	c) scratch test (hardened steel pin) electric strength test according to Cl. 18		N/A
19.11	Handles, levers, knobs, etc.:		N/A
	– insulating material		N/A
	– supplementary insulation covering		N/A
	– separated from shafts or fixing by supplementary insulation		N/A
19.12	Windings construction		P
19.12.1	Undue displacement in all types of transformers not allowed:		P
	– of input or output windings or turns thereof		P
	– of internal wiring or wires for external connection		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– of parts of windings or of internal wiring in case of rupture or loosening		P
19.12.2	Serrated tape:		P
	– distance through insulation according to table 13		P
	– one additional layer of serrated tape, and		P
	– one additional layer without serration		P
	– in case of cheekless bobbins the end turns of each layer shall be prevented from being displaced		P
19.12.3 (A1)	Insulated windings wires providing basic, supplementary or reinforced insulation, meet the following requirements:	Approved TIW used	P
	<ul style="list-style-type: none"> Multi-layer extruded or spirally wrapped insulation, passed the tests of annex K 		N/A
	<ul style="list-style-type: none"> Basic insulation: two wrapped or one extruded wire 		N/A
	<ul style="list-style-type: none"> Supplementary insulation: two layers, wrapped or extruded 		N/A
	<ul style="list-style-type: none"> Reinforced insulation: three layers wrapped or extruded 		N/A
	Spirally wrapped insulation:		N/A
	<ul style="list-style-type: none"> creepage distances between wrapped layers > cl. 26 _ P1 values 		N/A
	<ul style="list-style-type: none"> path between wrapped layers sealed, the test voltage of K2 is multiplied with 1,35 		N/A
	<ul style="list-style-type: none"> test 26.2.3 – Test A, passed for wrapped layers 		N/A
	<ul style="list-style-type: none"> the finished component pass the electric strength test according to cl. 18.3 		N/A
a)	Insulated winding wire used for basic or supplementary insulation in a wound part:		N/A
	<ul style="list-style-type: none"> comply with annex K 		N/A
	<ul style="list-style-type: none"> two layers for supplementary insulation 		N/A
	<ul style="list-style-type: none"> one layer for basic insulation 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation between the insulated wires of primary and secondary. This layer fulfils the requirement of basic insulation. 		N/A
b)	Insulated winding wire used for reinforced insulation in a wound part:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	<ul style="list-style-type: none"> comply with annex K 	Approved TIW used	P
	<ul style="list-style-type: none"> three layers 		P
	<ul style="list-style-type: none"> relevant dielectric strength test of 18.3 		P
	Where the insulated winding wire is wound:		N/A
	<ul style="list-style-type: none"> upon metal or ferrite cores 		N/A
	<ul style="list-style-type: none"> upon enamelled wire 		N/A
	<ul style="list-style-type: none"> under enamelled wire 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation between the insulated wires and the core or the enamelled wires is required. This layer fulfils the requirement of basic insulation. 		N/A
	<ul style="list-style-type: none"> both windings shall not touch each other and also not the core. 		N/A
	100 % routine test of Annex K3 of part 1 is fulfilled		N/A
	no creepage distances and clearances for insulated winding wirers		N/A
	for TIW wires values of box 2) c) of table 13, table C.1 and table D.1 of part 1 and of clause 26.106 are not required		N/A
FIW	<u>Transformers which use FIW wire</u>		N/A
19.12.101 (A1)	Max. class F for transformers which use FIW-wire		N/A
19.12.102 (A1)	FIW wires comply with IEC 60851-5, Ed.4.1; IEC 60317-0-7 and IEC 60317-56, Ed.1.		N/A
	<ul style="list-style-type: none"> other nominal diameter as mentioned in table 19.101 can be calculated with the formula after table 19.111 		N/A
	FIW wire used for basic or supplementary insulation for transformers according 19.1.2 (separating-transformers) of IEC 61558-2-16:		—
	<ul style="list-style-type: none"> the test voltage of table 8a – part 1, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 19.111 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation is located between the insulated wires of primary and secondary. This layer fulfil the requirement of basic insulation 		N/A
	<ul style="list-style-type: none"> between FIW and enamelled wire, no requirements of creepage distances and clearances 		N/A
	<ul style="list-style-type: none"> no touch of FIW and enamelled wires (grad 1, or grad 2 ...) 		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	FIW wire used for double or reinforced insulation for transformers according 19.1.3 (isolating and safety isolating transformers) of IEC 61558-2-16 (PRI and SEC basic insulated FIW-wire):		N/A
	<ul style="list-style-type: none"> the test voltage of table 8a – part 1, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 19.111 		N/A
	<ul style="list-style-type: none"> for primary and secondary winding FIW-wire for basic insulation is used 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation is located between the insulated wires of primary and secondary. This layer fulfil the requirement of basic insulation 		N/A
	<ul style="list-style-type: none"> no touch between the basic insulated PRI and SEC FIW-wires 		N/A
	<ul style="list-style-type: none"> between PRI- and SEC-FIW wires, no requirements of creepage distances and clearances 		N/A
	Alternative construction used for reinforced insulation (reinforced insulated FIW wire and enamelled wire)		N/A
	<ul style="list-style-type: none"> the test voltage of table 8a – part 1, based on the working voltage reinforced insulation, comply with the min. voltage strength of table 19.111 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation is located between the reinforced insulated FIW wire and the enamelled wire. This layer fulfil the requirement of basic insulation 		N/A
	<ul style="list-style-type: none"> no touch between the FIW wire and the enamelled wire 		N/A
	<ul style="list-style-type: none"> between the reinforced FIW wire and any other parts, no requirements of creepage distances and clearances exist 		N/A
	Alternative construction with FIW wires, basic or supplementary insulated for transformers with double or reinforced insulation according to 19.1.3 (basic/supplementary insulated FIW wire + enamelled wire + creepage distance and clearances for basic insulation)		—
	<ul style="list-style-type: none"> the test voltage of table 8a – part 1, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 19.111 		N/A
	<ul style="list-style-type: none"> PRI or SEC basic insulated FIW wire and to the other winding (enamelled wire) requirements of supplementary insulation 		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	<ul style="list-style-type: none"> creepage distances and clearances between the basic insulated FIW wire and the enamelled wire for basic or supplementary insulation are required. 		N/A
	Where the FIW wire is wound		N/A
	<ul style="list-style-type: none"> upon metal or ferrite cores 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation between the insulated wires and the core or the enamelled wires is required. This layer fulfils the requirement of basic insulation. 		N/A
	<ul style="list-style-type: none"> both windings shall not touch each other and also not the core. 		N/A
19.13	Handles, operating levers and the like shall be fixed		N/A
19.14	Protection against electric shock: covers securely fixed, 2 independent fixing means, one with tool		P
19.15	Transformer with pins for fixed socket-outlets: no strain on socket-outlet		N/A
	Additional torque 0,25 Nm		N/A
19.16	Protection index for portable transformers:		N/A
	200 VA IP20 and instructions for use		N/A
	> 200 VA 2,5 kVA IPX4 (single-phase)		N/A
	> 200 VA 6,3 kVA IPX4 (polyphase)		N/A
	> 2,5 VA (single-phase) IP21		N/A
	> 6,3 VA (polyphase) IP21		N/A
19.17	Transformers IPX1 - IPX6 totally enclosed, except for drain hole (diameter 5 mm or 20 mm ² with width 3 mm); drain hole not required for transformer completely filled with insulating materials		N/A
19.18	Transformers IPX1 with a moulded, if any		N/A
19.19	Class I transformers with a non-detachable flexible cable or cord with earth conductor and a plug with earth contact		N/A
19.20	Live parts of SELV and PELV-circuits: separation not less than PRI/SEC of a safety isolating transformer		N/A
	– SELV output circuits separated by double or reinforced insulation from all other than SELV or PELV circuits		N/A
	– SELV output circuits separated by basic insulation from other SELV or PELV circuits		N/A
19.20.1	SELV circuits and parts not connected to protective earth, to live parts, or protective conductors forming part of other circuits		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Nominal voltage (V) > 25 V a.c. or 60 V d.c., the required insulation fulfils the high voltage test according to table 8 a		N/A
19.20.2	PELV-circuits double or reinforced insulation is necessary		N/A
19.21	FELV-circuits: protection against contact fulfils the min. test voltage required for the primary circuit		N/A
19.22	Class II transformers shall not be provided with means for protective earth		P
	For fixed transformers an earth conductor with double or reinforced insulation to accessible metal parts is allowed		N/A
19.23	Class III transformers shall not be provided with means for protective earth		N/A

20	COMPONENTS		P
	Components such as switches, plugs, fuses, lamp holders, flexible cables and cords, comply with relevant IEC standard		P
	Components inside the transformer pass all tests of this standard together with the transformer tests		P
	Testing of components separately to the transformer according the relevant standard:		P
	– Ratings of the component in line with the transformer ratings, including inrush current. Component test according the component standard, based on the component marking (rating).		P
	– Components without markings tested under transformer conditions including inrush current.		N/A
	– If no IEC standard exists, the component is tested under transformer conditions.		P
20.1	Appliance couplers for main supply shall comply with:		N/A
	– IEC 60 320 for IPX0		N/A
	– IEC 60 309 for other		N/A
20.2	Automatic controls shall comply with IEC 60 730-1		N/A
20.3	Thermal-links comply with IEC 60691		N/A
20.4	Switches shall comply with annex F		N/A
	Disconnection from the supply:		N/A
	– by a switch, disconnecting all poles of the supply (full disconnection under the relevant over-voltage category		N/A
	– or a flexible supply cable and cord with plug		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– or an instruction sheet: disconnection by all-poles switches incorporated in fixed wiring		N/A
20.5	Socket-outlets of the output circuit shall be such that there is no unsafe compatibility to plugs complying with input circuit.		N/A
	Plugs and socket-outlets for SELV systems with both a rated current = 3A and a rated voltage =24 V shall comply with following:		N/A
	SELV plug and socket-outlets shall comply with IEC 60 884-2-4 and IEC 60 906-3		N/A
	– It is not possible for plugs to enter socket-outlets of other standardised voltage system		N/A
	– Socket outlets do not accommodate plugs of other standardised voltage systems		N/A
	– Socket outlets do not have a protective earth contact		N/A
	PELV plug and socket-outlets shall comply with following:		-
	– It is not possible for plugs to enter socket-outlets of other standardised voltage system		N/A
	– Socket outlets do not accommodate plugs of other standardised voltage systems		N/A
	– Socket outlets do not have a protective earth contact		N/A
	FELV plug and socket-outlets shall comply with following:		N/A
	– It is not possible for plugs to enter socket-outlets of other standardised voltage system		N/A
	– Socket outlets do not accommodate plugs of other standardised voltage systems		N/A
20.6	Thermal cut-outs, overload releases etc. have adequate breaking capacity		N/A
	– Thermal cut outs fulfil the relevant requirements of 20.7 and 20.8		N/A
	– Thermal links fulfil the relevant requirements of 20.8		N/A
	– The breaking capacity is in accordance with the relevant fuse standard		N/A
20.6.1	For Fuses According IEC 60127 and IEC 60269, the fuse current does not exceed 1,1 times of the rated value		P
20.7	Thermal cut outs shall meet the requirements of 20.7.1.1 and 20.7.2, or 20.7.1.2 and 20.7.2.		N/A
20.7.1	Requirements according to IEC 60730-1		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
20.7.1.1	Thermal cut-out tested as component shall comply with IEC 60 730-1		N/A
20.7.1.2	Thermal cut-out tested as a part of the transformer		N/A
	a) Thermal cut outs type 1 or type 2 (IEC 60730-1)		N/A
	b) Thermal cut outs fulfil the requirements of micro-interruption (type 1C or 2 C) or micro-disconnection, (type 1B or 2B) (see IEC 60730-1)		N/A
	c) Thermal cut outs with manual reset have a trip free mechanism (type 1E and 2E) (see IEC 60730-1)		N/A
	d) The number of cycles of automatic action shall be:		N/A
	– 3000 cycles for self-resetting thermal cut-outs		N/A
	– 300 cycles for non-self-resetting thermal cut-outs resetting by hand		N/A
	– 300 cycles for non-self-resetting thermal cut-outs resetting disconnecting		N/A
	– 30 cycles for non-self-resetting thermal cut-outs which are only resettable by a tool		N/A
	e) Thermal cut outs fulfil the electrical stress according IEC 60730-1, 6.14.2		N/A
	f) Characteristic of thermal cut-outs:		N/A
	– ratings according IEC 60730-1, cl. 5		N/A
	– classification according to:		N/A
	1) nature of supply to IEC 60730-1, cl. 6.1		N/A
	2) type of load controlled to IEC 60730-1, cl. 6.2		N/A
	3) degree of protection IPX0 to IEC 60730-1, cl. 6.5.1		N/A
	4) degree of protection IP0X to IEC 60730-1, cl. 6.5.2		N/A
	5) pollution degree to IEC 60730-1, cl. 6.5.3		N/A
	6) comparative tracking index to IEC 60730-1, cl. 6.13		N/A
	7) max. ambient temperature to IEC 60730-1, cl. 6.7		N/A
20.7.1.2	Thermal cut-out tested as a part of the transformer, test with 3 samples:		-
	– at least micro-interruption or micro-disconnection (IEC 60730-1)		N/A
	– 300 h aged at t_a (transformer) + 10°C		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– subjected to a number of cycles for automatic operating according 20.7.1.1		N/A
	During the test no sustaining arcing shall occur, during and after the test no damage at the thermal cut out and the transformer in the sense of this standard		N/A
20.7.2	Thermal cut-outs shall have adequate breaking capacity		-
20.7.2.1	The output of the transformer with a non-self-resetting thermal cut out is short circuited at a supply voltage 1, 1 of rated supply voltage. After opening of the cut off, the supply voltage is switched of, until the transformer is cooling down.		N/A
	– 3 cycles at 25° C for transformers without ta min		N/A
	– 3 cycles at ta min for transformers with ta min		N/A
	– after the 3 cycles short circuit of the output at 1,1 of rated supply voltage for 48 h.		N/A
	During the tests no sustaining arcing shall occur After the test: withstand the test of clause 18, show no damage in sense of this standard, and be operational.		N/A
20.7.2.2	The output of the transformer with a self-resetting thermal cut out is short circuited at a supply voltage 1, 1 of rated supply voltage.		N/A
	– 48 h at 25° C for transformers without ta min		N/A
	– 24 h at ta and 24 h at ta min for transformers with ta min		N/A
	During the tests no sustaining arcing shall occur After the test: withstand the test of clause 18, show no damage in sense of this standard, and be operational.		N/A
20.7.3	Test of a PTC resistor:		-
	5 cycles: transformer short-circuited for 48 h by 1,1 times of the input voltage and max. ta		N/A
	5 cycles: transformer short-circuited for 48 h by 0,9 times of the input voltage and min. ta (if declared)		N/A
	After the test: withstand the test of clause 18, show no damage in sense of this standard, and be operational.		N/A
20.8	Thermal links shall be tested in one of the following two ways.		-
20.8.1	Thermal-links shall comply with IEC 60 691 as a separate component.		N/A
	– electrical conditions to IEC 60691, cl. 6.1		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– thermal conditions to IEC 60691, cl. 6.2		N/A
	– ratings to IEC 60691, cl. 8 b		N/A
	– suitability of sealing components, impregnating fluids or cleaning solvents IEC 60691, cl. 8 c		N/A
20.8.2	Thermal-links tested as a part of the transformer:		N/A
	– ageing test 300 h by 35 °C or ta + 10 °C		N/A
	– After transformer fault condition the thermal link operate without sustaining arcing		N/A
	– after opening the thermal-link shall have an insulation resistance of at least 0,2 M		N/A
	– 3 cycles for replaceable thermal-links		N/A
	– 3 new specimens for not replaceable thermal-links		N/A
20.9	Self-resetting devices not used if mechanical, electrical, etc. hazards		N/A
20.10	Thermal cut-outs which can be reset by soldering operation are not allowed		N/A
20.9	Overload protection devices do not operate during test (20 times switched on and off, at no load); Upri (V): 1,1 times rated supply voltage.		P

21	INTERNAL WIRING		P
21.1	Internal wiring and electrical connections protected or enclosed		P
	Wire-ways smooth and free from sharp edges		P
21.2	Openings in sheet metal: edges rounded (radius 1,5 mm) or bushings of insulating material		N/A
21.3	Bare conductors: distances adequately maintained		N/A
21.4	When external wires are connected to terminal, internal wiring shall not work loose		P
21.5	Insulation of heat-resistant and non-hygroscopic material for insulated conductors subject to temperature rise > limiting values given in 14.1		P

22	SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CABLES AND CORDS		P
22.1	All cables, flexible cords etc. shall have appropriate current and voltage ratings		P
22.2	Input and output wiring inlet and outlet openings for external wiring: separate entries without damage to protective covering of cable or cord		P
	Input and output wiring inlet and outlet openings for flexible cables or cords: insulating material or bushing of insulating material		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Bushings for external wiring: reliably fixed, not of rubber unless part of cord guard		N/A
22.3	Fixed transformer:		P
	– possible to connect after fixing		P
	– inside space for wires allow easy introduction and connection of conductors		P
	– fitting of cover without damage to conductors		P
	– contact between insulation of external supply wires and live parts of different polarity not allowed		P
22.4	Length of power supply cord for portable transformers between 2 m and 4 m; without 0,5 mm ²		N/A
22.5	Power supply cords for transformers IPX0 and transformers "for indoor use only" \geq IPX0:		N/A
	– for transformers with a mass \leq 3 kg: 60227 IEC52 (H03VV-..) (60245 IEC 53)		N/A
	– for transformers with a mass $>$ 3 kg: 60227 IEC53 (H05VV-..) or 60245 IEC 53		N/A
	Power supply cords for transformers for outdoor use: \geq IPX0: 60245 IEC57 (H05RN-..)		N/A
22.6	Power supply cords for single-phase portable transformers with input current \leq 16A:		N/A
	– cord set fitted with an appliance coupler in accordance with IEC 60320		N/A
22.7	Nominal cross-sectional area (mm ²); input current (A) at rated output not less than shown in table 9		P
22.8	Class I transformer with power supply flexible cable: green/yellow core connected to earth terminal		N/A
	Plug for single-phase transformer with input current at rated output 16 A according to IEC 60 083, IEC 60 906-1 or IEC 60 309		N/A
22.9	Type X, Y or Z attachments: see relevant part 2		N/A
22.9.1	For type Z attachment: moulding enclosure and power supply cable do not affect insulation of cable		N/A
22.9.2	Inlet openings or inlet bushing: without risk of damage to protective covering of power supply cord		N/A
	Insulation between conductor and enclosure:		N/A
	– for Class I transformer: insulation of conductor plus separate basic insulation		N/A
	– for Class II transformer: insulation of conductor plus double or reinforced insulation		N/A
22.9.3	Inlet bushings:		N/A
	– no damage to power supply cord		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– reliably fixed		N/A
	– not removable without tool		N/A
	– not integral with power supply cord (for type X attachment)		N/A
	– not of natural rubber except for Class I transformer with type X, Y and Z attachments		N/A
22.9.4	For portable transformers which are moved while operating:		N/A
	– cord guards, if any, of insulating material and fixed		N/A
	Compliance is tested by the oscillating test according to fig. 7:		N/A
	– loaded force during the test according to fig. 7		N/A
	– 10 N for a cross-sectional area > 0,75		N/A
	– 5 N for a cross-sectional area 0,75		N/A
	After the test according to fig. 7:		N/A
	– no short-circuit between the conductors		N/A
	– no breakage of more than 10% of strands of any conductor		N/A
	– no separation of the conductor from the terminal		N/A
	– no loosening of any cord guards		N/A
	– no damage of the cord or cord guard		N/A
	– no broken strands piercing the insulation and not becoming accessible		N/A
22.9.5	Cord anchorages for type X attachment:		N/A
	– glands in portable transformers not used unless possibility for clamping all types and sizes of cable		N/A
	– moulded-on designs, tying the cable into a knot and tying the end with string not allowed		N/A
	– labyrinths, if clearly how, permitted		N/A
	– replacement of cable easily possible		N/A
	– protection against strain and twisting clearly how		N/A
	– suitable for different types of cable unless only one type of cable for transformer		N/A
	– the entire flexible cable or cord with covering can be mounted into the cord anchorage		N/A
	– if tightened or loosened no damage		N/A
	– no contact between cable or cord and accessible or electrically connected clamping screws		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– cord clamped by metal screw not allowed		N/A
	– one part securely fixed to transformer		N/A
	– for Class I transformer: insulating material or insulated from metal parts		N/A
	– for Class II transformers: insulating material or supplementary insulation from metal parts		N/A
	Cord anchorages for type X, Y, Z attachments: cores of power external flexible cable or cord insulated from accessible metal parts by:		N/A
	– basic insulation (Class I transformers), separate insulating barrier/cord anchorage		N/A
	– supplementary insulation (Class II transformers), special lining/cable or cord sheath of cable sheath of cable		N/A
	Cord anchorages for type X and Y attachments:		N/A
	– replacement of external flexible cable or cord does not impair compliance with standard		N/A
	– the entire flexible cable or cord with covering can be mounted into the cord anchorage		N/A
	– if tightened or loosened no damage		N/A
	– no contact between cable or cord and accessible or electrically connected clamping screws		N/A
	– cord clamped by metal screws not allowed		N/A
	– knots in cord not used		N/A
	– labyrinths, if clearly how, permitted		N/A
	Tests for type X with special cords, type Y, type Z		N/A
	Test for type X attachments one test with a cord with smallest and one test with a cord with the largest cross-sectional area:		N/A
	– for the test with clamping screws or tightened with torque 2/3 of that specified in table 11		N/A
	– not possible to push cable into transformer		N/A
	– 25 pulls of 1 s		N/A
	– 1 min torque according to table 10		N/A
	– mass (kg); pull (N); torque (Nm)		—
	– during test: cable not damaged		N/A
	– after test: longitudinal displacement 2 mm for cable or cord and 1 mm for conductors in terminals		N/A
	– creepage distances and clearances values specified in Cl. 26		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
22.9.6	Space for external cords or cable for fixed wiring and for type X and Y attachments:		N/A
	– before fitting cover, possibility to check correct connection and position of conductors		N/A
	– cover fitted without damage to supply cords		N/A
	– for portable transformers: contact with accessible metal parts if conductor becomes loose not allowed unless for type X and Y attachments terminations of cords do not slip free of conductor		N/A
	Space for external cords or cable for type X attachment and for connection to fixed wiring, in addition:		N/A
	– conductor easily introduced and connected		N/A
	– possibility of access to terminal for external conductor after removal of covers without special purpose tool		N/A

23	TERMINALS FOR EXTERNAL CONDUCTORS		P
23.1	Transformer for connection to fixed wiring and transformer without power supply cords with type Y and Z attachments: only connections by screws, nuts, terminals		P
	Terminals are integral part of the transformer:		P
	– comply with IEC 60 999-1 under transformer conditions		N/A
	Other terminals:		N/A
	– separately checked according to IEC 60 998-2-1, IEC 60 998-2-2 or IEC 60 947-7-1		N/A
	– used in accordance with their marking		N/A
	– checked according to IEC 60 999-1 under transformer conditions		P
	Transformer with type X attachments: soldered connection permitted if reliance not placed upon soldering, crimping or welding alone unless by barriers, creepage distances and clearances between hazardous live parts and metal parts should conductor break away 50% of specified value (Cl. 26)		N/A
	Transformer with type Y and Z attachments for external conductors: soldered, welded, crimped, etc. connections allowed		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For Class II transformer: reliance not placed upon soldering, crimping or welding alone unless by barriers, creepage distances and clearances between hazardous live parts and metal parts should conductor break away 50% of specified value (Cl. 26)		P
23.2	Terminals for type X with special cords Y and Z attachments shall be suitable for their purpose:		N/A
	– test by inspection according to 23.1 and 23.2		N/A
	– pull of 5 N to the connection before test according to 14.1		N/A
23.3	Other terminals than Y and Z attachments shall be so fixed that when the clamping means is tightened or loosened:		P
	– terminal does not work loose		P
	– internal wiring is not subjected to stress		P
	– creepage distances and clearance are not reduced below the values specified in Cl. 26		P
23.4	Other terminals than Y and Z attachments shall be so designed that:		P
	– they clamp the conductor between metallic surfaces with sufficient contact pressure		P
	– without damage to the conductor		P
	– test by inspection according to 23.3 and 23.4		P
	– 10 times fastening and loosening a conductor with the largest cross-sectional area with 2/3 of the torque specified in Cl. 25		P
23.5	Terminals for fixed wiring and for type X: located near their associated terminals of different polarities and the earth terminal if any		N/A
23.6	Terminal blocks not accessible without the aid of a tool	After mounting	P
23.7	Transformer with type X attachments: stranded conductor test (8 mm removed):		N/A
	– Class I transformers: no connection between live parts and accessible metal parts		N/A
	– free wire of earth terminal: no touching of live parts		N/A
	– Class II transformers: no connection between live parts and accessible metal parts, no connection between live parts and metal parts separated from accessible metal parts by supplementary insulation		N/A
23.8	Terminals for a current > 25 A:		N/A
	– pressure plate, or		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	– two clamping screws		N/A
23.9	When terminal, other than protective earth conductor, screws loosened as far as possible, no contact:		N/A
	– between terminal screws and accessible metal parts		N/A
	– between terminal screws and inaccessible metal parts for Class II transformers		N/A

24	PROVISION FOR PROTECTIVE EARTHING		P
24.1	Class I transformers: accessible conductive parts connected to earth terminal		N/A
	Class II transformers: no provision for earth		P
24.2	Protective earth terminal for connection to fixed wiring and for type X attachment transformers: comply with Cl. 23, adequately locked, not possible to loosen without a tool		N/A
24.3	No risk of corrosion from contact between metal of earth terminal and other terminal		N/A
	In case of earth terminal body of Al, no risk of corrosion from contact between Cu and Al		N/A
	Body of earth terminal or screws/nuts of brass or other metal resistant to corrosion		N/A
24.4	Resistance of connection between earth terminal and metal parts $\leq 0,1 \Omega$ with a min. 25 A or 1,5 rated input current at 1 min		N/A
24.5	Class I transformers with external flexible cables or cords:		N/A
	– current-carrying conductors becoming touch before the earth conductor		N/A

25	SCREWS AND CONNECTIONS		P
25.1	Screwed connections withstand mechanical stresses		P
	Screws transmitting contact pressure or likely to be tightened by the user or having a diameter < 2,8 mm, shall screw into metal		N/A
	Screws not of metal which is soft or liable to creep (Zn, Al)		P
	Screws of insulating material: not used for electrical connection		N/A
	Screws not of insulating material if their replacement by metal screws can impair supplementary or reinforced insulation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Screws to be removed (replacement etc. of power supply cord) not of insulating material if their replacement by metal screws can impair basic insulation		N/A
	No damage after torque test: diameter (mm); torque (Nm); ten times	2,4mm, 0,4Nm	P
	No damage after torque test: diameter (mm); torque (Nm); five times		N/A
25.2	Screws in engagement with thread of insulating material:		N/A
	– length of engagement $\geq 3 \text{ mm} + 1/2 \text{ screw diameter}$ or 8 mm		N/A
	– correct introduction into screw hole		N/A
25.3	Electrical connections: contact pressure not transmitted through insulating material		P
25.4	In case of use of thread-forming (sheet metal) screws for connection of current-carrying parts: clamping and locking means provided		N/A
	Thread-cutting (self-tapping) screws used for the connection of current-carrying parts allowed if they generate a full form machine screw thread and if not operated by the user		P
	Thread-cutting screws and thread-forming screws used for earth continuity allowed if at least 2 screws for each connection are used and it is not necessary to disturb the connection in normal use		N/A
25.5	Screws for current-carrying mechanical connections locked against loosening		N/A
	Rivets for current-carrying connections subject to torsion locked against loosening		N/A
25.6	Test of screwed glands with a torque according table 12. After the test no damage at the transformer and the gland.		N/A

26	CREEPAGE DISTANCES AND CLEARANCES		P
26.1	See 26.101		P
26.2	Creepage distances (cr) and clearances (cr)		P
26.2.1	Windings covered with adhesive tape		N/A
	– the values of pollution degree 1 are fulfilled		N/A
	– all isolating material are classified acc. to IEC 60085 and IEC 60216		N/A
	– test A of 26.2.3 is fulfilled		N/A
26.2.2	Uncemented insulating parts pollution degree P2 or P3	P2	P

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Clause	Requirement + Test	Result - Remark	Verdict
	– all isolating material are classified acc. to IEC 60085 and IEC 60216		P
	– values of pollution degree 1 are not applicable		P
26.2.3	Cemented insulating parts		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	– values of distance through insulation (dti) are fulfilled		N/A
	– creepage distances and clearances are not required		N/A
	– test A of this sub clause is fulfilled		N/A
	Test A		N/A
	– thermal class		N/A
	– working voltage		N/A
	– Test with three specially specimens, with un-insulated wires, without impregnation or potting	(see appended table)	N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,35		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,35 immediately at the end of the last cycle with high temperature		N/A
	Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
26.2.4	Enclosed parts, by impregnation or potting		N/A
26.2.4.1	– The requirements of reduced values as stated for pollution degree 1 (P1) are fulfilled		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	Test B		N/A
	– thermal class		N/A
	– working voltage		N/A
	– Test with three specially specimens, potted or impregnated. The dielectric strength test is applied directly to the joint.	(see appended table)	N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,25		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,25 immediately at the end of the last cycle with high temperature		N/A
	The three spacemen pass the Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
26.2.4.2	– The requirements of distance through insulation (dti) are fulfilled. (P1 values are not required)		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	Test C		N/A
	– thermal class		N/A
	– working voltage		N/A
	– Test with three specimens, potted or impregnated. (finished components)	(see appended table)	N/A
	– Neither cracks, nor voids in the insulating compounds		N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,35		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,35 immediately at the end of the last cycle with high temperature		N/A
	The three spacemen pass the Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
26.3	Distance through insulation		P
	For double or reinforced insulation, the required values of Tables 13, C1, and D1 – boxes 2b, 2c and 7 are fulfilled		P
	The insulation fulfil the material classification according IEC 60085 or 60216 or the test of 14.3		P
26.3.1	Reduced values of the thickness of insulation for supplementary or reinforced insulation are allowed if the following conditions are fulfilled:		N/A
	– the isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– the test of 14.3 is fulfilled		N/A
	– If both requirements are fulfilled, the required values for solid insulation can be multiplied by 0,4		N/A
	– Minimum thickness of reinforced insulation $\geq 0,2$ mm		N/A
	– Minimum thickness of supplementary insulation $\geq 0,1$ mm		N/A
26.3.2	Insulation in thin sheet form		P
	– If the layers are non-separable (glued together):		N/A
	– The requirement of 3 layers is fulfilled		N/A
	– The mandrel test according 26.3.3 is fulfilled with 150 N		N/A
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index "e" is fulfilled.		N/A
	– If the layers are separated:		P
	– The requirement of 2 layers is fulfilled		P
	– If serrated tape is used, 1 additional layer (serrated) and one additional layer without serration is required		P
	– The mandrel test according 26.3.3 is fulfilled on each layer with 50 N		P
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index "e" is fulfilled.		P
	– If the layers are separated (alternative:		N/A
	– The requirement of 3 layers is fulfilled		N/A
	– If serrated tape is used, 1 additional layer (serrated) and one additional layer without serration is required		N/A
	– The mandrel test according 26.3.3 is fulfilled on 2/3 of the layers with 100 N		N/A
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index "e" is fulfilled.		N/A
	Test according to 14.3 and if the isolating materials are classified acc. to IEC 60085 and IEC 60216 no distances through insulation are required for insulation in thin sheet form		P
	The figures within square brackets in box 2 and 7 of table 13 (C.1/D.1) are used for insulation in thin sheet form as follows:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– rated output > 100 VA values in square brackets apply		N/A
	– rated output $\geq 25 \text{ VA} \leq 100 \text{ VA}$ 2/3 of the value in square brackets apply		N/A
	– rated output $\leq 25 \text{ VA}$ 1/3 of the value in square brackets apply		P
26.3.3	Mandrel test of insulation in thin sheet form (specimen of 70 mm width are necessary):		P
	– If the layers are non-separable – at least 3 layers glued together fulfil the test:		N/A
	– pull force of 150 N		N/A
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdown.		N/A
	– If the layers are separable and 2/3 of at least 3 layers fulfil the test.		P
	– pull force of 100 N		P
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdowns.		P
	– If the layers are separable 1 of at least 2 layers fulfil the test:		N/A
	– pull force of 50 N		N/A
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdown.		N/A
26.101	Creepage distances, clearances and distances through insulation, specified values according to (EN 61558-2-16:09):		P
	– table 13, material group IIIa (part 1)		P
	– table C, material group II (part 1)		N/A
	– table D, material group I (part 1)		N/A
	– working voltage		P
	– rated supply frequency 50/60 Hz		P
	– rated internal frequency	60KHz	P
	1. Insulation between input and output circuits (basic insulation):		N/A
	a) measured values specified values (mm)		N/A
	2. Insulation between input and output circuits (double or reinforced insulation):		P
	a) measured values specified values (mm)	see appended table	P

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Clause	Requirement + Test	Result - Remark	Verdict
	b) measured values specified values (mm)		N/A
	c) measured values specified values (mm)	Dti: 1,5mm>0,1mm	P
	3. Insulation between adjacent input circuits: measured values specified values (mm) :		N/A
	Insulation between adjacent output circuits: measured values specified values (mm) :		N/A
	4. Insulation between terminals for external connection:		N/A
	a) measured values specified values (mm)		N/A
	b) measured values specified values (mm)		N/A
	c) measured values specified values (mm)		N/A
	5. Basic or supplementary insulation:		P
	a) measured values specified values (mm)	see appended table	P
	b) measured values specified values (mm)	see appended table	P
	c) measured values specified values (mm)		N/A
	d) measured values specified values (mm)		N/A
	e) measured values specified values (mm)		N/A
	6. Reinforced or double insulation: measured values specified values (mm)	see appended table	P
	7. Distance through insulation:		P
	a) measured values specified values (mm)		N/A
	b) measured values specified values (mm)		N/A
	c) measured values specified values (mm)	Dti:1,5mm>1,0mm	P
26.102	Values of IEC 61558-2-16 applicable for frequency up to 3 MHz (EN 61558-2-16:09)	see appended table	P
	For frequency above 3 MHz clause 7 of IEC 60664-4 is applicable (high frequency testing)		N/A
26.103	Clearance (EN 61558-2-16:09)		P
	a) Clearance for frequency ≥ 30 kHz according figure 101 two determinations are necessary:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– determination based on peak working voltage according Table 104 :		P
	Peak working voltage	372V	P
	Basic insulation: required / measured		N/A
	Double or reinforced insulation: required / measured value	0,36/8,0mm	P
	– and alternative if applicable for approximately homogeneous field according to Table 102		N/A
	Peak working voltage		N/A
	Basic insulation: required / measured		N/A
	Double or reinforced insulation: required / measured value		N/A
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		P
	The minimum clearance is the greater of the two values.		P
	b) Clearance for frequency ≤ 30 kHz according figure 101 two determinations are necessary:		N/A
	– determination based on peak working voltage with recurring peak voltages according Table 103 :		N/A
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		N/A
	The minimum clearance is the greater of the two values.		N/A
26.104	The working voltages of Table 102, 103 and 104 are peak voltages including μ sec peaks EN 61558-2-16:09)		P
	The working voltage according to Table 13 of part 1 are r.m.s. voltages		P
26.105	Creepage distances		P
	Two determinations of creepage distances are necessary (see Figure 102)		P
	– determination based on measured peak working voltage according Tables 105 to 110		P
	Peak working voltage		P
	Pollution degree	P2	P
	Basic or supplementary insulation: required / measured		N/A
	Double or reinforced insulation: required / measured value		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		N/A
	If the values based on table 105 to 110 are lower than the relevant values in Tables 13, C.1 or D.1, the higher values shall be applicable		P
26.106	Distance through insulation (EN 61558-2-16:09)		P
	Instead of partial discharge with high frequency voltage the test of the distance and the calculation of the electric field is applicable under the following conditions:		P
	– the max. frequency is < 10 MHz		P
	– the field strength approximately comply with Figure 103		P
	– no voids or gaps are present in between the solid insulation		P
	For thick layers $d1 \geq 0,75$ the peak value of the field strength is ≤ 2 kV/mm		P
	For thin layers $d2 \leq 30$ μ m the peak value of the field strength is ≤ 10 kV/mm		N/A
	For $d1 > d > d2$ equation (1) is used for calculation the field strength		N/A
26.107 (A1)	For transformers with FIW wires the following test is required		N/A
	• 10 cycles are required		N/A
	• 68 h test at max heating temperature + 10°C or test at max. allowed winding temperature based on the insulation class (required in table 1) + 10°C		N/A
	• 1 h at 25° C		N/A
	• 2 h at 0° C		N/A
	• 1 h at 25° C – (next cycle start again with 68 h max winding temp + 10)		N/A
	• during the 10 cycles test 2 x working voltage is connected between PRI and SEC		N/A
	• after 10 cycle test 2 transformers are subjected to the 17.2 test for 48 h and direct after the 48 h the dielectric strength test of 18.3 (100 % test voltage) is done		N/A
	• after the 10 cycle test the third sample is tested at the end of the last cycle in the hot position with the dielectric strength test of 18.3 (100 % test voltage)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	<ul style="list-style-type: none"> the partial discharge test according to 18.101 is done after the cycling test and after the high voltage test, if the peak working voltage is >750 V 		N/A
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27	RESISTANCE TO HEAT, FIRE AND TRACKING		P
27.1	Resistance to heat		-
	All insulating parts are resistant to heat		P
	For parts of rubber, which passed the test of 19.9, no additional test is required.		N/A
	The tests are not required for cables and small connectors with a rated current ≤ 3 A, a rated voltage ≤ 24 V a.c. or 60 V d.c. and a power ≤ 72 W		P
27.1.1	External accessible parts		-
	The Ball-pressure test -: diameter of impression 2 mm; heating cabinet temperature (° C) at 70 ° C or the temperature T of 14.1 (T + 15) - is fulfilled.	Front panel; 0,6mm at 70°C	P
27.1.2	Internal parts		-
	For insulating material retaining current carrying parts in position , the ball-pressure test -: diameter of impression 2 mm; heating cabinet temperature (° C) at 125 ° C or the temperature T of 14.1 (T + 15) - is fulfilled	Bobbin 0,5mm at 125° C Base 0,8mm at 125°C PCB 0,6mm, at 125°C Terminal base1,0mm at 125°C	P
27.2	Resistance to abnormal heat under fault conditions		N/A
27.3	Resistance to fire		P
	All isolating parts of the transformer shall be resistant to ignition and spread of fire. The test according to IEC 60696-2-10 is required		P
27.3.1	External accessible parts (glow wire tests)		P
	– 650° C for enclosures	see appended table	P
	– 650 ° C for parts retaining current carrying parts in position and terminals for external conductors Current $\leq 0,2$ A		N/A
	– 750° C for parts retaining current carrying parts in position and terminals for external conductors with fixed wiring. Current > 0,2 A		N/A
	– 850° C for parts retaining current carrying parts in position and terminals for external conductors with non-fixed wiring. Current > 0,2 A		N/A
27.3.2	Internal parts		P
	– 550° C for internal insulating material – not retaining current carrying parts in position		N/A
	– 650° C for coil formers (bobbins)		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– 650 ° C for parts retaining current carrying parts in position and terminals for external conductors. Current $\leq 0,2$ A		N/A
	– 750° C for parts retaining current carrying parts in position and terminals for external conductors with fixed wiring. Current $> 0,2$ A		N/A
	– 850° C for parts retaining current carrying parts in position and terminals for external conductors with non-fixed wiring. Current $> 0,2$ A	PCB	P
27.4	For IP other than IPX0:If insulating parts retaining current carrying parts in position and under P3 conditions, the material resistance to tracking is at least material of group IIIa		N/A
	Test (175 V): no flashover or breakdown before 50 drops		N/A

28	RESISTANCE TO RUSTING		N/A
	Ferrous parts protected against rusting		N/A
IEC 61558-1			
Clause	Requirement + Test	Result - Remark	Verdict

E	ANNEX E , GLOW WIRE TEST		P
	The test is required according to IEC 60695-2-10 and IEC 60695-2-11 with the following additions:		P
E.1	Clause 6, "Severities" of IEC 6095-2-11, apply with the temperature stated in 27.3 of IEC 61558-1		P
E2	Clause 8, "Conditioning", of IEC 60695-2-11 apply, preconditioning is required		P
E3	Clause 10, "Test Procedure", of IEC 60695-2-11 apply, The tip of the glow wire is applied to the flat side of the surface.		P

F	ANNEX F, REQUIREMENTS FOR MANUALLY OPERATED SWITCHES WHICH ARE PARTS OF THE TRANSFORMER		N/A
F.2	Manually operated mechanical switches, tested as separate component, shall comply with IEC 61058 under the conditions of F2.		N/A
F.§	Manually operated mechanical switches tested as part of the transformer shall comply with the conditions specified under F.3		N/A

H	ANNEX H, ELECTRONIC CIRCUITS (IEC 61558-1)		P
H1	General notes on tests (addition to clause 5)		P

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
H.2	SHORT-CIRCUIT AND OVERLOAD PROTECTION (ADDITION TO CLAUSE 15)		P
H.2.1	Circuits designed and applied so that fault conditions do not render the appliance unsafe		P
	During and after each test:		P
	– temperatures do not exceed values specified in table 3 of Cl. 15.1		P
	– transformer complies with conditions specified in sub-clause 15.1		P
	If a conductor of a pcb becomes open circuited, the transformer is considered to have withstood the particular test, provided that all six conditions as specified are met		N/A
H.2.2	Fault conditions a) to f) of sub-clause H.2.3 are not tested if the following conditions are met:		N/A
	– electronic circuit is a low-power circuit as specified		N/A
	– safety of the appliance as specified does not rely on correct functioning of the electronic circuit		N/A
H.2.3	Fault conditions tested as specified when relevant:		P
	a) short-circuit of creepage distances and clearances, if less than specified in Cl. 26		N/A
	b) open circuit at the terminals of any component		P
	c) short-circuit of capacitors, unless they comply with IEC 60 384-14		P
	d) short-circuit of any two terminals of an electronic component as specified		P
	e) any failure of an integrated circuit as specified		P
	f) low-power circuit: low-power points are connected to the supply source		N/A
	Cl. 15 is repeated with a simulated fault as indicated in a) to e), if the transformer incorporates an electronic circuit to ensure compliance with Cl. 15		P
	Fault condition e) is applied for encapsulated and similar components		P
	PTC's and NTC's are not short-circuited if they are used as specified		N/A
H.2.4	If for a fuse-link complying with IEC 60 127-3 rated fuse current I1 is used, current I2 is measured as specified:		P
	– if $I_2 < 2,1 \times I_1$ test of 15.8 is repeated with fuse-link short-circuited		N/A
	– if $I_2 > 2,75 \times I_1$, no other tests are necessary		P

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Clause	Requirement + Test	Result - Remark	Verdict

	If $I_2 > 2,1 \times I_1$ and $I_2 < 2,75 \times I_1$ test of 15.8 is repeated as specified		N/A
	For fuses other than those complying with IEC 60 127-3, the test is carried out as specified 15.3.2 to 15.3.5		N/A

H.3	CREEPAGE DISTANCES, CLEARANCES AND DISTANCES THROUGH INSULATION		N/A
H.3.1	For live parts separated by basic insulation smaller cr and cl as in 26 are allowed, if H2 is fulfilled.		N/A
	In optocouplers no requirements of cr and cl		N/A
	For coatings annex W applies. Smaller distances as required in IEC 60664-3, clause 4 are applicable,		N/A
	For potted transformers cycling tests acc, 26.2. are applicable		N/A
H.3.2	The ma. surface temperature of optocouplers is 50 K		N/A

K (A1)	ANNEX K, INSULATED WINDING WIRES FOR USE AS MULTIPLE LAYER INSULATION		P
K.1	Wire construction:		P
	<ul style="list-style-type: none"> insulated winding wire for basic or supplementary insulation (see 19.12.3) 		N/A
	<ul style="list-style-type: none"> insulated winding wire for reinforced insulation (see 19.12.3) 	Approved TIW used	P
	<ul style="list-style-type: none"> solid circular winding wires and stranded winding wires with 0,05 to 5 mm diameter 		N/A
	<ul style="list-style-type: none"> spirally wrapped insulation - overlapping 		N/A
K.2	Type tests		N/A
K.2.1	General Tests between ambient temperature between 15° C and 35° C and at an humidity between 45% and 75 %		N/A
K.2.2	Electric strength test		N/A
K.2.2.1	Solid circular winding wires and stranded winding wires		N/A
	Test samples prepared according to clause 4.4.1 of IEC 60851-5:2008 (twisted pair)		N/A
	Dielectric strength test: 6 kV for reinforced insulation		N/A

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict
	Dielectric strength test: 3 kV for basic or supplementary insulation		N/A
K.2.2.2	Square or rectangular wires .		N/A
	Test samples prepared according to clause 4.7.1 of IEC 60851-5:2008		N/A
	Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
K.2.3	Flexibility and adherence		N/A
	Claus 5.1 in Test 8 of IEC 60851-3:2009 shall be used		N/A
	Test samples prepared according to clause 5.1.1.4 of IEC 60851-3:2009		N/A
	Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
	Mandrel diameter according table K.1		N/A
	The tension to the wire during winding on mandrel is 118 N/mm ² (118 MPa)		N/A
K.2.4	Heat shock		N/A
	Test samples prepared according to 3.1.1 (in Test 9) of IEC 60851-6:1996		N/A
	<ul style="list-style-type: none"> high voltage test immediately after this test 		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 5,5 kV for reinforced insulation 		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 2,75 kV for basic or supplementary insulation 		N/A
K.2.5	Retention of dielectric strength after bending (test as specified under test 13 of 4.6.1 c) of IEC 60 851-5)		N/A
	<ul style="list-style-type: none"> high voltage test immediately after this test Dielectric strength test: 5,5 kV for reinforced insulation Dielectric strength test: 2,75 kV for basic or supplementary insulation 		N/A
K.3.1	General Tests as subjected in K.3.2 and K.3.3		N/A
K.3.2	Routine test		N/A


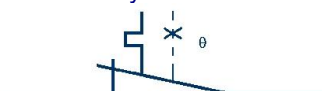
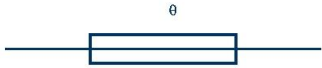

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

	<ul style="list-style-type: none"> Dielectric strength test: 4,2 kV for reinforced insulation 		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 2,1 kV for basic or supplementary insulation 		N/A
K.3.3	Sampling test		N/A
K.3.3.1	Solid circular winding wires and stranded winding wires		N/A
	Test with a twisted pair, prepared according clause 4.4.1 of IEC 60851-5:2008		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 6 kV for reinforced insulation 		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 3 kV for basic or supplementary insulation 		N/A
K.3.3.2	Square rectangular wire		N/A
	Samples prepared according to clause 4.7.1 of IEC 60851-5:2008		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 5,5 kV for reinforced insulation 		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 3 kV for basic or supplementary insulation 		N/A

U	ANNEX U – INFORMATIVE – OPTIONAL TW – MARKING FOR TRANSFORMERS		N/A
	The tests of Annex U are based on constant $S = 4500$. Other constants are possible, if the test of U.5.2 is done with positive result.		N/A
U1	General notes and tests		N/A
	8 transformers of one type are necessary for the test. Tests according U5.		N/A
U.2	Heating (addition to clause 14)		N/A
14.4	Thermal endurance test		N/A
	Test according U5 and measurements according 11.1		N/A
	Transformers tested as an integral part of the equipment (option), assigned with tw		N/A
	The thermal conditions are so adjusted, that the duration of test is as indicated by the manufacturer.		N/A
	If no indications are given, the test period is 30 days		N/A
	After the test, when the transformers have returned to room temperature, they fulfil the following requirements:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	a) The output voltage has not changed from the measured value at the beginning by more than allowed value of clause 11.1		N/A
	b) The insulation resistance between input and output winding and between windings and body is, measured with 500 V d.c. , not less than 1 MOhm		N/A
	c) The transformer fulfil the dielectric strength test with 35% of the values in Clause 18, Table 8.a.		N/A
	The test result is positive, is min. 6 of the 7 samples have passed the test.		N/A
	The test result is negative, if 2 or more samples fail the test		N/A
	If the result is negative, the test can be repeated with 7 new samples		N/A
U.3	Short circuit and overload protection (addition to clause 15)		N/A
	At short circuit and overload tests the winding temperature if less than the required value of table U.1		N/A
U.5	General requirements and information about thermal endurance test on windings		N/A
U.5.1	Thermal endurance test		N/A
	Transformers tested at rated output		N/A
	Loads outside of the oven		N/A
	7 transformers are placed in the oven		N/A
	The temperature of the hottest winding of each of the 7 transformers is-together with the oven temperature, at the applicable temperature of table U.2		N/A
	After 4 hours measuring of the actual winding temperatures. Regulation of the oven temperature if necessary		N/A
	After 24 hours again measuring of the winding temperature. The temperatures of the 7 samples are very near to the required temperature of the values of table U.2. The test time of the coldest winding is not longer than twice the theoretical test time based on table U.2		N/A
U.5.2	The use of constant S other than 4500 in tw tests		-
U.5.2.1	Procedure a)		N/A
	The manufacturer prepares test results with a minimum of samples of 30.		N/A
	T and log L are calculated from the dates		N/A
	The diagram according to Figure U.2 will be founded.		N/A
U.5.2.3	Procedure b)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The testing authority shall test 14 new transformers		N/A
	Test 1, based on clause U.5.1 but at the calculated test room temperature for 10 days. The test is continued until all transformer fail.		N/A
	Calculation of the mean life L2 at temperature T2 according to U4		N/A
	Test 2, based on clause U.5.1 but at a calculated room temperature T2 (for 120 days).The test time with T2 exceeds L2.		N/A
	If all transformers fail before L2, the result is negative.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
V	ANNEX V, SYMBOLS TO BE USED FOR THERMAL CUT-OUTS		N/A
V.2.1.1	Restored by manual operation  IEC 489/98		N/A
V.2.1.2	Restored by disconnection of the supply  IEC 490/98		N/A
V.2.1.3	Thermal link  IEC 491/98		N/A
V.2.2	Self-resetting thermal cut-out  IEC 492/98		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

11 and 12		TABLE: OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD; NO-LOAD OUTPUT VOLTAGE				P
Clause		11		12		
type/rated output/	rated voltage (V)	sec. voltage (V)	delta Usec (%)	Usec V no-load output	delta Usec no-load output %	further information
LM60044/ (5VDC/2,1A)	100- 250VA C	Max.4,8V DC	4%	Max.5,04DC	5,0%	-

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Clause	Requirement + Test	Result - Remark	Verdict

14	TABLE: HEATING						P
type/rated output	r-cold Ω	r-warm Ω	temp. °C	ext. encl. °C	support °C	int. + ext. wire	further information
LM60044/ 5VDC, 2.1A	-	-	Max.109,7	Max.45,4	Max.71,5	Max.74,3	Input 275Vac
LM60044/ 5VDC, 2.1A	-	-	Max.88,9	Max.40,2	Max.64,0	Max.62,9	Input 90Vac
Supplementary information:							
14	TABLE: Heating Test						P
	Test voltage (V)		275V~				—
	Ambient (°C)		25				—
Thermocouple Locations			max. temperature measured, (°C)				max. tempera- ture limit, (°C)
winding			109,7				110
panel			45,4				80
base			71,5				80
Internal wire			74,3				105
supports			71,5				85
PCB			91,4				105

IEC 61558-2-16			
Clause	Requirement + Test	Result - Remark	Verdict

15	TABLE: SHORT-CIRCUIT AND OVERLOAD PROTECTION						P
	ambient temperature (°C)						
type/rated output	r-cold Ω	r-warm Ω	temp. °C	ext. encl. °C	support °C	int. + ext. wire	further information
LM60044/ 5VDC, 2.1A	-	-	56,3	33,1	44,8	44,8	Input 275Vac. (SC)
LM60044/ 5VDC, 2.1A	-	-	29,4	26,4	28,0	28,0	Input 90Vac (SC)
LM60044/ 5VDC, 2.1A	-	-	112,0	47,9	87,9	87,9	Input 250Vac (OL)
LM60044/ 5VDC, 2.1A	-	-	92,0	45,0	66,2	66,2	Input 100Vac (OL)

15	TABLE: Short circuit and overload protection			
	Test voltage (V) :			—
	Ambient (°C) :			—
Thermocouple Locations		max. temperature measured, (°C)		max. temperature limit, (°C)
Supplementary information:				

15	TABLE: Short circuit and overload protection			
	Test voltage (V) :			—
	Ambient (°C) :			—
Thermocouple Locations		max. temperature measured, (°C)		max. temperature limit, (°C)
Supplementary information:				

18.2	TABLE: insulation resistance measurements		P
Insulation resistance R between:		R (MΩ)	Required R (MΩ)
Between mains poles (primary fuse disconnected)		1000	2
Between parts separated by double or reinforced insulation		1000	7
Supplementary information:			

18.3	TABLE: Dielectric Strength		P
Test voltage applied between:		Test potential applied (V)	Breakdown / flashover (Yes/No)
Between live parts and output circuit		4200V	No
Between live parts and external enclosure		4200V	No
Between primary winding of transformer and secondary winding of transformer		4200V	No
L/N		2100V	No
Supplementary information:			

20	TABLE: Critical components information (See CDF)					P
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity ¹⁾	
Supplementary information:						

25	TABLE: Threaded Part Torque Test				P
Threaded part identification		Diameter of thread (mm)	Column number (I, II, or III)	Applied torque (Nm)	
Input wiring terminal		2,4	II	0,4	
Supplementary information:					

26	TABLE: Clearance And Creepage Distance Measurements					P
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
L to N	-	-	7,3	3,0	7,3	3,0
Input to output	-	-	4,6	5,5	5,0	9,0
Live part to enclosure	-	-	4,6	8,0	5,0	8,0
Supplementary information:						

26	TABLE: Distance Through Insulation Measurements				P
Distance through insulation di at/of:		U r.m.s. (V)	Test voltage (V)	Required di (mm)	di (mm)
Enclosure		-	-	1,0	min.1,5
Supplementary information:					

26.2 TEST A	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
	Test with three special prepared specimens with uninsulated wires, without potting or impregnation					
	cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	
1.						

26.2 TEST A	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
	Test with three special prepared specimens with uninsulated wires, without potting or impregnation					
	cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

BB.26.2 TEST B	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
	Test with three specially prepared specimens with potted – P1 values are required					
	cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

26.2 TEST C	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
------------------------	--	--	--	--	--	-----

	Test with three specially prepared specimens with potting (only dti is required)				
	cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

26.107 61558-2- 16/A1	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
	Test for transformers, use FIW-wire					
	cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

27	TABLE: Resistance to heat and fire - Glow wire tests							P
Object/ Part No./ Material	Manufac- turer/ trademark	Glow wire test (GWT); (°C)						Verdict
		550	650		750		850	
			te	ti	te	ti		
panel	-	-	0	0	-	-	-	P
Bobbin	-	--	0	0	-	-	0	P
PCB	-	-	-	-	-	-	0	P
Object/ Part No./ Material	Manufac- turer/ trademark	Glow-wire flammability index (GWFI), °C				GW ignition temp. (GWIT), °C		Verdict
		550	650	750	850	675	775	

:								
If no, then surrounding parts passed the needle-flame test of annex E (Yes/No) :								N/A
The test specimen passed the test by virtue of most of the flaming material being withdrawn with the glow-wire (Yes/No)? :								Yes
Ignition of the specified layer placed underneath the test specimen (Yes/No) :								No
Supplementary information: 550 °C GWT not relevant (or applicable) to parts of material classified at least HB40 or if relevant HBF The GWIT pre-selection option, the 850 °C GWFI pre-selection option, and the 850 °C GWT are not relevant (or applicable) for attended appliances.								

Annex U	U.5.1 THERMAL ENDURANCE TEST													
Type ref.														
Rated PRI-Voltage														
Rated SEC-Voltage														
Material of Winding														
Material of bobbin														
Material of resin														
Material of potting														
Material of foil														
Components removed for test														
tw														
S														
Objective test duration (days)														
Theoretical test temperature														
Sample	1		2		3		4		5		6		7	
Winding	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC
Start – Rk														
After 4 h – Rw														
After 4 h – winding temperature														
After 4 h - oven temperature														
After 24 h – Rw														
After 24 h – winding temperature														
After 24 h - oven														







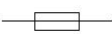




temperature							
Final test period (days)							
Output voltage (11.1) under load							
Insulating resistance							
High voltage test (35% of the values in Table 8.a)							

















Annex U	U.5.2 The use of another constant S other than 4500 in tw tests Test1:10 days													
Type ref.														
Rated PRI-Voltage														
Rated SEC-Voltage														
Material of Winding														
Material of bobbin														
Material of resin														
Material of potting														
Material of foil														
Components removed for test														
tw														
S														
Objective test duration (days)														
Theoretical test temperature														
Sample	1		2		3		4		5		6		7	
Winding	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC
Start – Rk														
After 4 h – Rw														
After 4 h – winding temperature														
After 4 h - oven temperature														
After 24 h – Rw														
After 24 h – winding temperature														
After 24 h - oven temperature														

Final test period (days)							
Output voltage (11.1) under load							
Insulating resistance							
High voltage test (35% of the values in Table 8.a)							
IEC 61558-2-16							
Clause	Requirement + Test				Result - Remark		Verdict

Annex U	U.5.2 The use of another constant S other than 4500 in tw tests Test2:120 days													
Type ref.														
Rated PRI-Voltage														
Rated SEC-Voltage														
Material of Winding														
Material of bobbin														
Material of resin														
Material of potting														
Material of foil														
Components removed for test														
tw														
S														
Objective test duration (days)														
Theoretical test temperature														
Sample	1		2		3		4		5		6		7	
Winding	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC	PRI	SEC
Start – Rk														
After 4 h – Rw														
After 4 h – winding temperature														
After 4 h - oven temperature														
After 24 h – Rw														
After 24 h – winding temperature														
After 24 h - oven														

temperature							
Final test period (days)							
Output voltage (11.1) under load							
Insulating resistance							
High voltage test (35% of the values in Table 8.a							

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Clause	Requirement + Test	Result - Remark	Verdict
AA	Annex AA		N/A
	Partial discharge (PD) test		N/A
BB	Annex BB		N/A
	Particular requirements for associated transformers for switch mode power supplies with internal frequencies > 500 Hz		N/A
	See separate test report-form for these Annex.		N/A
BB.8	MARKING AND OTHER INFORMATION		N/A
BB.8.2	Marking for transformers IP00 or for associated transformers: type and trademark, instruction sheets		N/A
BB.8.11	Correct symbols:		N/A
	Volts	V	N/A
	Amperes	A (mA)	N/A
	Volt amperes (or volt-amperes reactive for reactors)	VA or (VAR)	N/A
	Watts	W	N/A
	Hertz	Hz	N/A
	Input	PRI	N/A
	Output	SEC	N/A
	Direct current	d.c. (DC) or 	N/A
	Neutral	N	N/A
	Single-phase a.c.		N/A
	Three-phase a.c.	3 	N/A
	Three-phase and neutral a.c.	3N 	N/A
	Power factor	cosφ	N/A
	Class II construction		N/A
	Class III construction		N/A
	Fuse-link		N/A
	Rated max. ambient temperature	t_a	N/A
	Frame or core terminal		N/A
	Protective earth		N/A
	IP number	IPXX	N/A
	Earth (ground for functional earth)		N/A
	For indoor use only		N/A
	tw5 YYY		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	tw10 YYY		N/A
	twx YYY		N/A
	Additional Symbols (IEC 61558-2-16:09)		N/A
	SMPS incorporating a Fail-safe separating transformer	 or 	N/A
	Additional Symbols (IEC 61558-2-16:09)		N/A
	SMPS incorporating a Non-short-circuit-proof separating transformer	 or 	N/A
	SMPS incorporating a Short-circuit-proof separating transformer (inherently or non-inherently)	 or 	N/A
	SMPS incorporating a Fail-safe isolating transformer	 or 	N/A
	SMPS incorporating a Non-short-circuit-proof isolating transformer	 or 	N/A
	SMPS incorporating a Short-circuit-proof isolating transformer (inherently or non-inherently)	 or 	N/A
	SMPS incorporating a Fail-safe safety isolating transformer		N/A
	SMPS incorporating a Non-short-circuit-proof safety isolating transformer		N/A
	SMPS incorporating a Short-circuit-proof safety isolating transformer (inherently or non-inherently)		N/A
	SMPS (Switch mode power supply unit)		N/A

BB.9	PROTECTION AGAINST ELECTRIC SHOCK	N/A
BB.10	CHANGE OF INPUT VOLTAGE SETTING	N/A
BB.11	OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD	N/A
BB.12	NO-LOAD OUTPUT VOLTAGE (see supplementary requirements in Part 2)	N/A
BB.13	SHORT-CIRCUIT VOLTAGE	N/A
BB.14	HEATING	N/A
BB.14.2	Application of 14.1 or 14.3 according to the insulation system	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
BB.14.2.1	Class of isolating system (classified materials according to IEC 60 085 and IEC 60 216)		N/A
BB.14.2.2	No classified material, or system but the measured temperature does not exceed the value of Class A		N/A
BB.14.2.3	No classified material or system but the measured temperature exceeds the value for Class A, the live parts of the transformers are submitted to the test of 14.3		N/A
BB.14.3	Accelerated ageing test for undeclared class of isolating system		N/A
	Cycling test (10 cycles):		N/A
	– measuring of the no-load input current (mA)		N/A
BB.14.3.1	– heat run (temperature in table 2)		N/A
BB.14.3.2	– vibration test: 30 min; amplitude 0,35 mm; frequency range: 10 Hz, 55 Hz, 10 Hz		N/A
BB.14.3.3	– moisture treatment (48 h, 17.2)		N/A
BB.14.3.4	Measurements and tests at the beginning and after each test:		N/A
	– deviation of the no-load input current, measured at the beginning of the test is 30%		N/A
	– insulation resistance acc. cl.18.1 and 18.2		N/A
	– electric strength, no breakdown (18.3); 2 min; test voltage 35% of specified value (table VI)		N/A
	– Transformers (50 or 60 Hz version) are tested after the dielectric strength test as follows: under no load; duration: 5 min; Upri(V):1,2 times rated supply voltage; frequency (Hz): 2 times rated frequency		N/A
BB.15	SHORT-CIRCUIT AND OVERLOAD PROTECTION		N/A
BB.16	MECHANICAL STRENGTH		N/A
BB.17	PROTECTION AGAINST HARMFUL INGRESS OF WATER AND MOISTURE		N/A
BB.18	INSULATION RESISTANCE AND ELECTRIC STRENGTH		N/A
BB.18.2	Insulation resistance between:		N/A
	– live parts and body for basic insulation 2 M		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– live parts and body for reinforced insulation 7 M		N/A
	– input circuits and output circuits for basic insulation 2 M		N/A
	– input circuits and output circuits for double or reinforced insulation 5 M		N/A
	– each input circuit and all other input circuits connected together 2 M		N/A
	– each output circuit and all other output circuits connected together 2 M		N/A
	– hazardous live parts and metal parts with basic insulation (Class II transformers) 2 M		N/A
	– body and metal parts with basic insulation (Class II transformers) 5 M		N/A
	– metal foil in contact with inner and outer surfaces of enclosures 2 M		N/A
BB.18.3	Electric strength test (1 min): no flashover or breakdown:		N/A
	1) basic insulation between input circuits and output circuits; working voltage (V); test voltage (V)		N/A
	2) double or reinforced insulation between input circuits and output circuits; working voltage (V); test voltage (V)		N/A
	3) basic or supplementary insulation between:		N/A
	a) live parts of different polarity; working voltage (V); test voltage (V)		N/A
	b) live parts and the body if intended to be connected to protective earth		N/A
	c) inlet bushings and cord guards and anchorages		N/A
	d) live parts and an intermediate conductive part		N/A
	e) intermediate conductive parts and body		N/A
	4) Reinforced insulation between the body and live parts; working voltage (V); test voltage (V)		N/A
	5) Functional insulation for windings intended to be connected in series or parallel (test voltage = working voltage + 500 V) (IEC 61558-2-16:2009)		N/A
18.102 (A1)	Partial discharge tests according IEC 60664-1 , if the working voltage is > 750 V peak		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	Partial discharge is ≤ 10 pC at time P2 See Fig. 19.101		N/A
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BB.19	CONSTRUCTION		N/A
BB.19.1	Separation of input and output circuits		N/A
BB.19.1.1	SMPS incorporating auto-transformers (IEC 61558-2-16:2009)		N/A
BB.19.1.2	SMPS incorporating separating transformers (IEC 61558-2-16:2009)		N/A
BB.19.1.2.1	Input and output circuits electrically separated. (IEC 61558-2-16:09)		N/A
BB.19.1.2.2	The insulation between input and output winding(s) consist of basic insulation (IEC 61558-2-16:09)		N/A
	Class I SMPS		N/A
	– Insulation between input windings and body consist of basic insulation		N/A
	– Insulation between output windings and body consist of basic insulation		N/A
	Class II SMPS (IEC 61558-2-16:09)		N/A
	– Insulation between input windings and body consist of double or reinforced insulation		N/A
	– Insulation between output windings and body consist of double or reinforced insulation		N/A
BB.19.1.2.3	The insulation between input windings and intermediate conductive parts and the output windings and intermediate part consist of basic insulation (IEC 61558-2-16:09)		N/A
	For class I SMPS the insulation between input and output windings via the intermediate conductive parts consist of basic insulation (IEC 61558-2-16:09)		N/A
	For class II SMPS the insulation between input winding and the body and between the output windings and the body via the intermediate conductive parts consist of double or reinforced insulation (IEC 61558-2-16:09)		N/A
BB.19.1.2.4	Parts of output circuits may be connected to protective earth (IEC 61558-2-16:09)		N/A
BB.19.1.2.5	No direct contact between output circuits and the body, unless: (IEC 61558-2-16:2009)		N/A
	– Allowed for associated transformers by the equipment standard		N/A
	– Clause 19.8 of part 1 is fulfilled		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
BB.19.1.3	SMPS incorporating isolating transformers and safety isolating transformers (IEC 61558-2-16:09)		N/A
BB.19.1.3.1	Input and output circuits electrically separated (IEC 61558-2-16:09)		N/A
	No possibility of any connection between these circuits		N/A
BB.19.1.3.2	The insulation between input and output winding(s) consist of double or reinforced insulation (exception see 19.1.3.4) (IEC 61558-2-16:09)		N/A
	Class I SMPS not intended for connection to the mains by a plug:		—
	– Insulation between input windings and body connected to earth consist of basic insulation rated to the input voltage		N/A
	– Insulation between output windings and body, connected to earth consist of basic insulation rated for the output voltage		N/A
	Class I SMPS intended for connection to the mains by a plug (EN 61558-2-16:09):		N/A
	– Insulation between input windings and body connected to earth consist of basic insulation rated to the working voltage		N/A
	– Insulation between output windings and body, connected to earth consist of supplementary insulation rated for the working voltage		N/A
	Class II SMPS (IEC 61558-2-16:09)		N/A
	– Insulation between input windings and body consist of double or reinforced insulation rated to the input voltage		N/A
	– Insulation between output windings and body consist of double or reinforced insulation, rated to the output voltage		N/A
BB.19.1.3.3	SMPS with intermediate conductive parts not connected to the body (between input/output) (EN 61558-2-16:09):		-
19.1.3.3.1	For class I and class II SMPS the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation, rated to the working voltage (EN 61558-2-16:09)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	<ul style="list-style-type: none"> For class II SMPS the insulation between input winding and the body and between the output windings and the body via the intermediate conductive parts consist of double or reinforced insulation. (rated to the input voltage, for SELV circuits only basic insulation to the body)) 		N/A
	<ul style="list-style-type: none"> For transformers, different from independent, the insulation between input and output windings, via intermediate conductive parts, consist of double or reinforced insulation, rated to the working voltage. 		N/A
BB.19.1.3.3.2	Class I transformers with earthed core, and not allowed for class II equipment (EN 61558-2-16:09)		N/A
	<ul style="list-style-type: none"> Insulation from the input to the earthed core: basic insulation rated for the input voltage 		N/A
	<ul style="list-style-type: none"> Insulation from the output voltage to the earthed core: basic insulation rated for the output voltage 		N/A
BB.19.1.3.3.3	Insulation between : input to intermediate conductive parts and output and intermediate parts consist of at least basic insulation (EN 61558-2-16:09)		N/A
	<ul style="list-style-type: none"> If the insulation from input or output to the intermediate metal part is less than basic insulation, the part is considered to be connected to input or output. 		N/A
BB.19.1.3.4	For class I SMPS, with protective screen, not connected to the mains by a plug the following conditions comply (EN 61558-2-16:09):		N/A
	<ul style="list-style-type: none"> The insulation between input winding and protective screen consist of basic insulation (rated input voltage) 		N/A
	<ul style="list-style-type: none"> The insulation between output winding and protective screen consist of basic insulation (rated output voltage) 		N/A
	<ul style="list-style-type: none"> The protective screen consist of metal foil or a wire wound screen extending the full width of the windings and has no gaps or holes 		N/A
	<ul style="list-style-type: none"> Where the protective screen does not cover the entire width of the input winding, additional insulation to ensure double insulation in this area, is used. 		N/A
	<ul style="list-style-type: none"> If the screen is made by a foil, the turns are isolated, overlap at least 3 mm 		N/A
	<ul style="list-style-type: none"> The cross-section of the screen and the lead out wire is at least corresponding to the rated current of the overload device 		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– The lead our wire is soldered or fixed to the protective screen.		N/A
	Protective screening is not allowed for SMPS with plug connection to the mains (EN 61558-2-16:09)		N/A
BB.19.1.3.5	No connection between output circuit and protective earth, except of associated transformers (allowed by equipment standard) or 19.8 is fulfilled (EN 61558-2-16:09)		N/A
BB.19.1.3.6	No connection between output circuit and body, except of associated transformers (allowed by equipment standard) (EN 61558-2-16:09)		N/A
BB.19.1.3.7	The distance between input and output terminals for the connection of external wiring is 25 mm		N/A
BB.19.1.3.8	Portable SMPS having an rated output ≤ 630 VA (EN 61558-2-16:09)		N/A
BB.19.1.3.9	No connection between output circuit, and body except of associated transformers (allowed by equipment standard) (EN 61558-2-16:09)		N/A
BB.19.1.3.10	Protective screening is not allowed for SMPS with plug connection to the mains (EN 61558-2-16:09)		N/A
BB.19.11	Handles, levers, knobs, etc.:		N/A
	– insulating material		N/A
	– supplementary insulation covering		N/A
	– separated from shafts or fixing by supplementary insulation		N/A
BB.19.12	Windings construction		N/A
BB.19.12.1	Undue displacement in all types of transformers not allowed:		N/A
	– of input or output windings or turns thereof		N/A
	– of internal wiring or wires for external connection		N/A
	– of parts of windings or of internal wiring in case of rupture or loosening		N/A
BB.19.12.2	Serrated tape:		N/A
	– distance through insulation according to table 13		N/A
	– one additional layer of serrated tape, and		N/A
	– one additional layer without serration		N/A
	– in case of cheek less bobbins the end turns of each layer shall be prevented from being displaced		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
BB.19.12.3 (A1)	Insulated windings wires providing basic, supplementary or reinforced insulation, meet the following requirements:		N/A
	<ul style="list-style-type: none"> Multi-layer extruded or spirally wrapped insulation, passed the tests of annex K 		N/A
	<ul style="list-style-type: none"> Basic insulation: two wrapped or one extruded wire 		N/A
	<ul style="list-style-type: none"> Supplementary insulation: two layers, wrapped or extruded 		N/A
	<ul style="list-style-type: none"> Reinforced insulation: three layers wrapped or extruded 		N/A
	Spirally wrapped insulation:		N/A
	<ul style="list-style-type: none"> creepage distances between wrapped layers > cl. 26 _ P1 values 		N/A
	<ul style="list-style-type: none"> path between wrapped layers sealed, the test voltage of K2 is multiplied with 1,35 		N/A
	<ul style="list-style-type: none"> test 26.2.3 – Test A, passed for wrapped layers 		N/A
	<ul style="list-style-type: none"> the finished component pass the electric strength test according to cl. 18.3 		N/A
a)	Insulated winding wire used for basic or supplementary insulation in a wound part:		N/A
	<ul style="list-style-type: none"> comply with annex K 		N/A
	<ul style="list-style-type: none"> two layers for supplementary insulation 		N/A
	<ul style="list-style-type: none"> one layer for basic insulation 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation between the insulated wires of primary and secondary. This layer fulfils the requirement of basic insulation. 		N/A
b)	Insulated winding wire used for reinforced insulation in a wound part:		N/A
	<ul style="list-style-type: none"> comply with annex K 		N/A
	<ul style="list-style-type: none"> three layers 		N/A
	<ul style="list-style-type: none"> relevant dielectric strength test of 18.3 		N/A
	Where the insulated winding wire is wound:		N/A
	<ul style="list-style-type: none"> upon metal or ferrite cores 		N/A
	<ul style="list-style-type: none"> upon enamelled wire 		N/A
	<ul style="list-style-type: none"> under enamelled wire 		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	<ul style="list-style-type: none"> one layer for mechanical separation between the insulated wires and the core or the enamelled wires is required. This layer fulfils the requirement of basic insulation. 		N/A
	<ul style="list-style-type: none"> both windings shall not touch each other and also not the core. 		N/A
	100 % routine test of Annex K3 of part 1 is fulfilled		N/A
	no creepage distances and clearances for insulated winding wirers		N/A
	for TIW wires values of box 2) c) of table 13, table C.1 and table D.1 of part 1 and of clause 26.106 are not required		N/A
FIW	<u>Transformers which use FIW wire</u>		-
BB 19.12.101 (A1)	Max. class F for transformers which use FIW-wire		N/A
BB 19.12.102 (A1)	FIW wires comply with IEC 60851-5, Ed.4.1; IEC 60317-0-7 and IEC 60317-56, Ed.1.		N/A
	<ul style="list-style-type: none"> other nominal diameter as mentioned in table 19.101 can be calculated with the formula after table 19.111 		N/A
	FIW wire used for basic or supplementary insulation for transformers according 19.1.2 (separating-transformers) of IEC 61558-2-16:		—
	<ul style="list-style-type: none"> the test voltage of table 8a – part 1, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 19.111 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation is located between the insulated wires of primary and secondary. This layer fulfil the requirement of basic insulation 		N/A
	<ul style="list-style-type: none"> between FIW and enamelled wire, no requirements of creepage distances and clearances 		N/A
	<ul style="list-style-type: none"> no touch of FIW and enamelled wires (grad 1, or grad 2 ...) 		N/A
	FIW wire used for double or reinforced insulation for transformers according 19.1.3 (isolating and safety isolating transformers) of IEC 61558-2-16 (PRI and SEC basic insulated FIW-wire):		N/A
	<ul style="list-style-type: none"> the test voltage of table 8a – part 1, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 19.111 		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	<ul style="list-style-type: none"> for primary and secondary winding FIW-wire for basic insulation is used 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation is located between the insulated wires of primary and secondary. This layer fulfil the requirement of basic insulation 		N/A
	<ul style="list-style-type: none"> no touch between the basic insulated PRI and SEC FIW-wires 		N/A
	<ul style="list-style-type: none"> between PRI- and SEC-FIW wires, no requirements of creepage distances and clearances 		N/A
	Alternative construction used for reinforced insulation (reinforced insulated FIW wire and enamelled wire)		N/A
	<ul style="list-style-type: none"> the test voltage of table 8a – part 1, based on the working voltage reinforced insulation, comply with the min. voltage strength of table 19.111 		N/A
	<ul style="list-style-type: none"> one layer for mechanical separation is located between the reinforced insulated FIW wire and the enamelled wire. This layer fulfil the requirement of basic insulation 		N/A
	<ul style="list-style-type: none"> no touch between the FIW wire and the enamelled wire 		N/A
	<ul style="list-style-type: none"> between the reinforced FIW wire and any other parts, no requirements of creepage distances and clearances exist 		N/A
	Alternative construction with FIW wires, basic or supplementary insulated for transformers with double or reinforced insulation according to 19.1.3 (basic/supplementary insulated FIW wire + enamelled wire + creepage distance and clearances for basic insulation)		—
	<ul style="list-style-type: none"> the test voltage of table 8a – part 1, based on the working voltage of basic or supplementary insulation, comply with the min. voltage strength of table 19.111 		N/A
	<ul style="list-style-type: none"> PRI or SEC basic insulated FIW wire and to the other winding (enamelled wire) requirements of supplementary insulation 		N/A
	<ul style="list-style-type: none"> creepage distances and clearances between the basic insulated FIW wire and the enamelled wire for basic or supplementary insulation are required. 		N/A
	Where the FIW wire is wound		N/A
	<ul style="list-style-type: none"> upon metal or ferrite cores 		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	<ul style="list-style-type: none"> one layer for mechanical separation between the insulated wires and the core or the enamelled wires is required. This layer fulfils the requirement of basic insulation. 		N/A
	<ul style="list-style-type: none"> both windings shall not touch each other and also not the core. 		N/A
BB.20	COMPONENTS		N/A
BB.21	INTERNAL WIRING		N/A
BB.22	SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CABLES AND CORDS		N/A
BB.23	TERMINALS FOR EXTERNAL CONDUCTORS		N/A
BB.24	PROVISION FOR PROTECTIVE EARTHING		N/A
BB.25	SCREWS AND CONNECTIONS		N/A
BB.26	CREEPAGE DISTANCES AND CLEARANCES		N/A
BB.26.1	See 26.101		N/A
BB.26.2	Creepage distances (cr) and clearances (cr)		N/A
BB.26.2.1	Windings covered with adhesive tape		N/A
	– the values of pollution degree 1 are fulfilled		N/A
	– all isolating material are classified acc. to IEC 60085 and IEC 60216		N/A
	– test A of 26.2.3 is fulfilled		N/A
BB.26.2.2	Uncemented insulating parts pollution degree P2 or P3		N/A
	– all isolating material are classified acc. to IEC 60085 and IEC 60216		N/A
	– values of pollution degree 1 are not applicable		N/A
BB.26.2.3	Cemented insulating parts		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	– values of distance through insulation (dti) are fulfilled		N/A
	– creepage distances and clearances are not required		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– test A of this sub clause is fulfilled		N/A
	Test A		N/A
	– thermal class		N/A
	– working voltage		N/A
	– Test with three specially specimens, with un-insulated wires, without impregnation or potting	(see appended table)	N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,35		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,35 immediately at the end of the last cycle with high temperature		N/A
	Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
BB.26.2.4	Enclosed parts, by impregnation or potting		N/A
BB.26.2.4.1	– The requirements of reduced values as stated for pollution degree 1 (P1) are fulfilled		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	Test B		N/A
	– thermal class		N/A
	– working voltage		N/A
	– Test with three specially specimens, potted or impregnated. The dielectric strength test is applied directly to the joint.	(see appended table)	N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,25		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,25 immediately at the end of the last cycle with high temperature		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The three spacemen pass the Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
BB.26.2.4.2	– The requirements of distance through insulation (dti) are fulfilled. (P1 values are not required)		N/A
	– all isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	Test C		N/A
	– thermal class		N/A
	– working voltage		N/A
	– Test with three specimens, potted or impregnated. (finished components)	(see appended table)	N/A
	– Neither cracks, nor voids in the insulating compounds		N/A
	Two of the three specimens are subjected to:		N/A
	– the relevant humidity treatment according to 17.2 (48 h)		N/A
	– the relevant dielectric strength test of 18.3 multiplied with factor 1,35		N/A
	– One of the three specimens is subjected to the relevant dielectric strength test of 18.3 multiplied by the factor 1,35 immediately at the end of the last cycle with high temperature		N/A
	The three spacemen pass the Impulse dielectric test according to 4.1.1.2.1 of IEC 60 664-1 (1,2 / 50 s waveform) – see Annex R of IEC 61558-1		N/A
BB.26.3	Distance through insulation		N/A
	For double or reinforced insulation, the required values of Tables 13, C1, and D1 – boxes 2b, 2c and 7 are fulfilled		N/A
	The insulation fulfil the material classification according IEC 60085 or 60216 or the test of 14.3		N/A
BB.26.3.1	Reduced values of the thickness of insulation for supplementary or reinforced insulation are allowed if the following conditions are fulfilled:		N/A
	– the isolating materials are classified acc. to IEC 60085 and IEC 60216		N/A
	– the test of 14.3 is fulfilled		N/A
	– If both requirements are fulfilled, the required values for solid insulation can be multiplied by 0,4		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– Minimum thickness of reinforced insulation $\geq 0,2$ mm		N/A
	– Minimum thickness of supplementary insulation $\geq 0,1$ mm		N/A
BB.26.3.2	Insulation in thin sheet form		N/A
	– If the layers are non-separable (glued together):		N/A
	– The requirement of 3 layers is fulfilled		N/A
	– The mandrel test according 26.3.3 is fulfilled with 150 N		N/A
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index "e" is fulfilled.		N/A
	– If the layers are separated:		N/A
	– The requirement of 2 layers is fulfilled		N/A
	– If serrated tape is used, 1 additional layer (serrated) and one additional layer without serration is required		N/A
	– The mandrel test according 26.3.3 is fulfilled on each layer with 50 N		N/A
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index "e" is fulfilled.		N/A
	– If the layers are separated (alternative:		N/A
	- The requirement of 3 layers is fulfilled		N/A
	– If serrated tape is used, 1 additional layer (serrated) and one additional layer without serration is required		N/A
	– The mandrel test according 26.3.3 is fulfilled on 2/3 of the layers with 100 N		N/A
	– The required values for d.t.i. of Tables 13, C.1 and D.1 – marked by index "e" is fulfilled.		N/A
	Test according to 14.3 and if the isolating materials are classified acc. to IEC 60085 and IEC 60216 no distances through insulation are required for insulation in thin sheet form		N/A
	The figures within square brackets in box 2 and 7 of table 13 (C.1/D.1) are used for insulation in thin sheet form as follows:		N/A
	– rated output > 100 VA values in square brackets apply		N/A
	– rated output 25 VA 100 VA 2/3 of the value in square brackets apply		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– rated output ___ 25 VA 1/3 of the value in square brackets apply		N/A
BB.26.3.3	Mandrel test of insulation in thin sheet form (specimen of 70 mm width are necessary):		N/A
	– If the layers are non-separable – at least 3 layers glued together fulfil the test:		N/A
	– pull force of 150 N		N/A
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdown.		N/A
	– If the layers are separable and 2/3 of at least 3 layers fulfil the test.		N/A
	– pull force of 100 N		N/A
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdowns.		N/A
	– If the layers are separable 1 of at least 2 layers fulfil the test:		N/A
	– pull force of 50 N		N/A
	– high voltage test of 5,0 kV or the test voltage of 18.3 multiplied by 1,25 whatever is the greater. No flashover, no breakdown.		N/A
BB.26.101	Creepage distances, clearances and distances through insulation, specified values according to (EN 61558-2-16:09):		N/A
	– table 13, material group IIIa (part 1)		N/A
	– table C, material group II (part 1)		N/A
	– table D, material group I (part 1)		N/A
	– working voltage		N/A
	– rated supply frequency 50/60 Hz		N/A
	– rated internal frequency		N/A
	1. Insulation between input and output circuits (basic insulation):		N/A
	a) measured values specified values (mm)		N/A
	2. Insulation between input and output circuits (double or reinforced insulation):		N/A
	a) measured values specified values (mm)		N/A
	b) measured values specified values (mm)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	c) measured values specified values (mm)		N/A
	3. Insulation between adjacent input circuits: measured values specified values (mm)		N/A
	Insulation between adjacent output circuits: measured values specified values (mm)		N/A
	4. Insulation between terminals for external connection:		N/A
	a) measured values specified values (mm)		N/A
	b) measured values specified values (mm)		N/A
	c) measured values specified values (mm)		N/A
	5. Basic or supplementary insulation:		N/A
	a) measured values specified values (mm)		N/A
	b) measured values specified values (mm)		N/A
	c) measured values specified values (mm)		N/A
	d) measured values specified values (mm)		N/A
	e) measured values specified values (mm)		N/A
	6. Reinforced or double insulation: measured values specified values (mm)		N/A
	7. Distance through insulation:		N/A
	a) measured values specified values (mm)		N/A
	b) measured values specified values (mm)		N/A
	c) measured values specified values (mm)		N/A
BB.26.102	Values of IEC 61558-2-16 applicable for frequency up to 3 MHz (EN 61558-2-16:09)		N/A
	For frequency above 3 MHz clause 7 of IEC 60664-4 is applicable (high frequency testing)		N/A
BB.26.103	Clearance (EN 61558-2-16:09)		N/A
	a.) Clearance for frequency ≥ 30 kHz according figure 101 two determinations are necessary:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	– determination based on peak working voltage according Table 104 :		N/A
	Peak working voltage		N/A
	Basic insulation: required / measured		N/A
	Double or reinforced insulation: required / measured value		N/A
	– and alternative if applicable for approximately homogeneous field according to Table 102		N/A
	Peak working voltage		N/A
	Basic insulation: required / measured		N/A
	Double or reinforced insulation: required / measured value		N/A
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		N/A
	The minimum clearance is the greater of the two values.		N/A
	b.) Clearance for frequency ≤ 30 kHz according figure 101 two determinations are necessary:		N/A
	– determination based on peak working voltage with recurring peak voltages according Table 103 :		N/A
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		N/A
	The minimum clearance is the greater of the two values.		N/A
BB.26.104	The working voltages of Table 102, 103 and 104 are peak voltages including μ sec peaks EN 61558-2-16:09)		N/A
	The working voltage according to Table 13 of part 1 are r.m.s. voltages		N/A
BB.26.105	Creepage distances		N/A
	Two determinations of creepage distances are necessary (see Figure 102)		N/A
	– determination based on measured peak working voltage according Tables 105 to 110		N/A
	Peak working voltage		N/A
	Pollution degree		N/A
	Basic or supplementary insulation: required / measured		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Double or reinforced insulation: required / measured value		N/A
	– determination based on measured r.m.s. working voltage according Tables 13, C1 and D1 (see clause 26.101)		N/A
	If the values based on table 105 to 110 are lower than the relevant values in Tables 13, C.1 or D.1, the higher values shall be applicable		N/A
BB.26.106	Distance through insulation (EN 61558-2-16:09)		N/A
	Instead of partial discharge with high frequency voltage the test of the distance and the calculation of the electric field is applicable under the following conditions:		N/A
	– the max. frequency is < 10 MHz		N/A
	– the field strength approximately comply with Figure 103		N/A
	– no voids or gaps are present in between the solid insulation		N/A
	For thick layers $d1 \geq 0,75$ the peak value of the field strength is ≤ 2 kV/mm		N/A
	For thin layers $d2 \leq 30 \mu\text{m}$ the peak value of the field strength is ≤ 10 kV/mm		N/A
	For $d1 > d > d2$ equation (1) is used for calculation the field strength		N/A
BB.26.107 (A1)	For transformers with FIW wires the following test is required		N/A
	• 10 cycles are required		N/A
	• 68 h test at max heating temperature + 10°C or test at max. allowed winding temperature based on the insulation class (required in table 1) + 10°C		N/A
	• 1 h at 25° C		N/A
	• 2 h at 0° C		N/A
	• 1 h at 25° C – (next cycle start again with 68 h max winding temp + 10)		N/A
	• during the 10 cycles test 2 x working voltage is connected between PRI and SEC		N/A
	• after 10 cycle test 2 transformers are subjected to the 17.2 test for 48 h and direct after the 48 h the dielectric strength test of 18.3 (100 % test voltage) is done		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

	<ul style="list-style-type: none"> after the 10 cycle test the third sample is tested at the end of the last cycle in the hot position with the dielectric strength test of 18.3 (100 % test voltage) 		N/A
	<ul style="list-style-type: none"> the partial discharge test according to 18.101 is done after the cycling test and after the high voltage test, if the peak working voltage is >750 V 		N/A

BB.27	RESISTANCE TO HEAT, FIRE AND TRACKING		N/A
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Clause	Requirement + Test	Result - Remark	Verdict

BB.E	ANNEX E , GLOW WIRE TEST		N/A
	The test is required according to IEC 60695-2-10 and IEC 60695-2-11 with the following additions:		N/A
BB.E.1	Clause 6, "Severities" of IEC 6095-2-11, apply with the temperature stated in 27.3 of IEC 61558-1		N/A
BB.E2	Clause 8, "Conditioning", of IEC 60695-2-11 apply, preconditioning is required		N/A
BB.E3	Clause 10, "Test Procedure", of IEC 60695-2-11 apply, The tip of the glow wire is applied to the flat side of the surface.		N/A

BB.F	ANNEX F, REQUIREMENTS FOR MANUALLY OPERATED SWITCHES WHICH ARE PARTS OF THE TRANSFORMER		N/A
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BB.H	ANNEX H, ELECTRONIC CIRCUITS (IEC 61558-1)		N/A
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BB.K 61558-2-16/A1	ANNEX K, INSULATED WINDING WIRES FOR USE AS MULTIPLE LAYER INSULATION		N/A
BB.K.1	Wire construction:		N/A
	<ul style="list-style-type: none"> insulated winding wire for basic or supplementary insulation (see 19.12.3) 		N/A
	<ul style="list-style-type: none"> insulated winding wire for reinforced insulation (see 19.12.3) 		N/A
	<ul style="list-style-type: none"> split circular winding wires and stranded winding wires with 0,05 to 5 mm diameter 		N/A
	<ul style="list-style-type: none"> spirally wrapped insulation - overlapping 		N/A
BB.K.2	Type tests		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
BB.K.2.1	General Tests between ambient temperature between 15° C and 35° C and at an humidity between 45% and 75 %		N/A
BB K.2.2	Electric strength test		N/A
BB K.2.2.1	Solid circular winding wires and stranded winding wires		N/A
	Test samples prepared according to clause 4.4.1 of IEC 60851-5:2008 (twisted pair)		N/A
	Dielectric strength test: 6 kV for reinforced insulation		N/A
	Dielectric strength test: 3 kV for basic or supplementary insulation		N/A
BB K.2.2.2	Square or rectangular wires .		N/A
	Test samples prepared according to clause 4.7.1 of IEC 60851-5:2008		N/A
	Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
BB K.2.3	Flexibility and adherence		N/A
	Claus 5.1 in Test 8 of IEC 60851-3:2009 shall be used		N/A
	Test samples prepared according to clause 5.1.1.4 of IEC 60851-3:2009		N/A
	Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
	Mandrel diameter according table K.1		N/A
	The tension to the wire during winding on mandrel is 118 N/mm ² (118 MPa)		N/A
BB.K.2.4	Heat shock		N/A
	Test samples prepared according to 3.1.1 (in Test 9) of IEC 60851-6:1996		N/A
	• high voltage test immediately after this test		N/A
	• Dielectric strength test: 5,5 kV for reinforced insulation		N/A
	• Dielectric strength test: 2,75 kV for basic or supplementary insulation		N/A
BB.K.2.5	Retention of dielectric strength after bending (test as specified under test 13 of 4.6.1 c) of IEC 60 851-5)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	<ul style="list-style-type: none"> high voltage test immediately after this test Dielectric strength test: 5,5 kV for reinforced insulation Dielectric strength test: 2,75 kV for basic or supplementary insulation 		N/A
BB.K.3	Testing during manufacturing		N/A
BB.K.3.1	General Tests as subjected in K.3.2 and K.3.3		N/A
BB K.3.2	Routine test		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 4,2 kV for reinforced insulation 		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 2,1 kV for basic or supplementary insulation 		N/A
BB K.3.3	Sampling test		N/A
BB K.3.3.1	Solid circular winding wires and stranded winding wires		N/A
	Test with a twisted pair, prepared according clause 4.4.1 of IEC 60851-5:2008		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 6 kV for reinforced insulation 		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 3 kV for basic or supplementary insulation 		N/A
BB K.3.3.2	Square rectangular wire		N/A
	Samples prepared according to clause 4.7.1 of IEC 60851-5:2008		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 5,5 kV for reinforced insulation 		N/A
	<ul style="list-style-type: none"> Dielectric strength test: 3 kV for basic or supplementary insulation 		N/A
BB.U	ANNEX U – INFORMATIVE – OPTIONAL TW – MARKING FOR TRANSFORMERS		N/A
V	ANNEX V, SYMBOLS TO BE USED FOR THERMAL CUT-OUTS		N/A

BB.26.2 TEST A		TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION				N/A
		Test with three special prepared specimens with uninsulated wires, without potting or impregnation				
cycles with 2 x working voltage between pri / sec		68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

BB.26.2 TEST B		TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION				N/A
		Test with three specially prepared specimens with potted – P1 values are required				
cycles with 2 x working voltage between pri / sec		68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C	
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

BB.26.2 TEST C	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
	Test with three specially prepared specimens with potting (only dti is required)					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

BB.26.107 61558-2- 16/A1	TABLE: CREEPAGE DISTANCES AND CLEARANCES AND DISTANCES THROUGH INSULATION					N/A
	Test for transformers, use FIW-wire					
cycles with 2 x working voltage between pri / sec	68 h at the temperature acc. Cl. 14 (min. 85 °C)	1 hour 25 °C	2 hour 0 °C	1 hour 25 °C		
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
IEC 61558-2-16 Annex BB						
Clause	Requirement + Test			Result - Remark		Verdict

	TABLE: Dielectric Strength		N/A
Test voltage applied between:	Test potential applied (V)	Breakdown / flashover (Yes/No)	
Supplementary information:			

BB 18.3	TABLE: insulation resistance measurements		N/A
Insulation resistance R between:	R (MΩ)	Required R (MΩ)	
Between mains poles (primary fuse disconnected)			
Between parts separated by basic or supplementary insulation			
Between parts separated by double or reinforced insulation			
Supplementary information:			

BB 26	TABLE: Clearance And Creepage Distance Measurements					N/A
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Supplementary information:						

BB 26	TABLE: Distance Through Insulation Measurements			N/A
Distance through insulation di at/of:	U r.m.s. (V)	Test voltage (V)	Required di (mm)	di (mm)
Supplementary information:				